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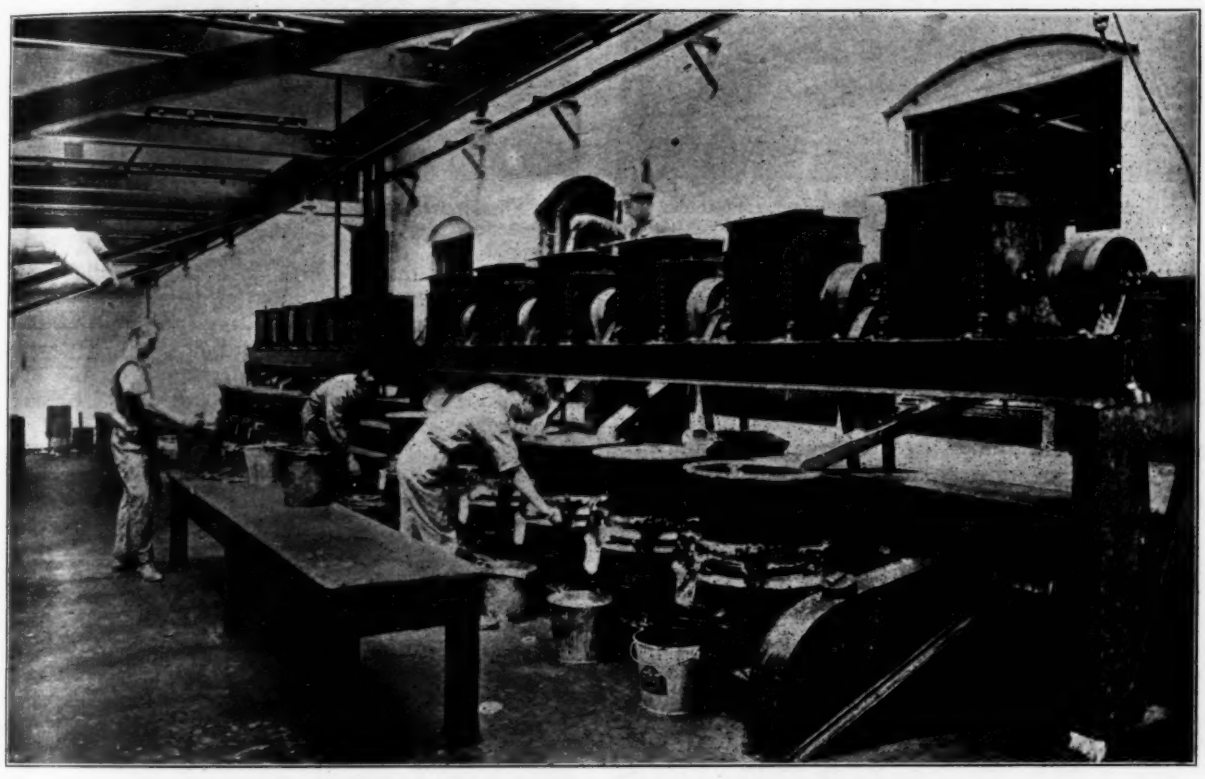


Motor-Driven Machines for Mixing the Paint Used in Printing Linoleum.

Motor Drive in a Linoleum Factory

Electric Motors Served by Central-Station Service Give Maximum Output at Minimum Cost at Armstrong Cork Works

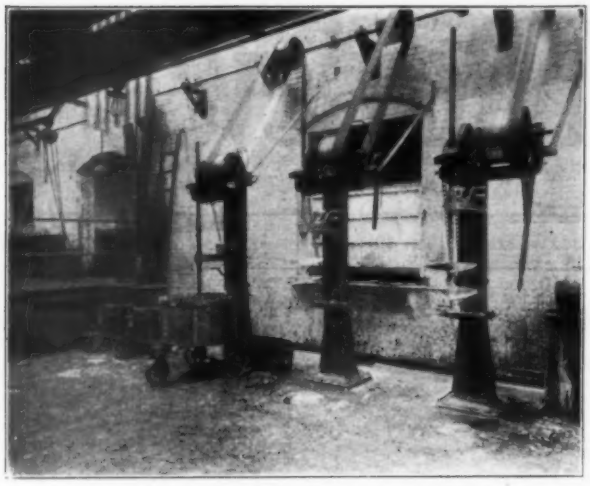
By P. B. FINDLEY

CLEANLINESS is the watchword of any factory making floor coverings and particularly where the product is one on which dirt is so conspicuous as linoleum. Not only this factor, but the elimination of bother and expense of a generating station decided the Armstrong Cork Company to purchase electric power from a central station, even though its processes require a considerable amount of low-pressure steam for heating.

The manufacture of linoleum involves the grinding and mixing of cork flour, oxidized linseed oil, and coloring matter. This "mix" is then rolled out into sheets of the desired thickness. In the case of solid-color and printed linoleum, a backing of burlap to give tensile strength is rolled into the mixture. Inlaid linoleum is made of bits of separate colors laid up into a pattern which is then pressed into the burlap backing. For each process several weeks' seasoning is necessary in heated rooms.

In the Armstrong factory, raw cork scrap, received from various sources, is stored in a warehouse adjacent to railroad sidings. As required, the bales are opened, and the odd pieces fed to two breakers, direct-driven by a 35-horsepower motor. The bits of cork are then blown through a chute into storage bins, from which they are fed by gravity into the mills. Two pairs are driven each by a 100-horsepower motor, through Morse silent chains and others by individual 50-horsepower motors.

To protect the motors from the sprinkler discharge in case of fire, galvanized iron screens are provided at each head, and a tarpaulin is kept near each motor to



Motor-Driven German Mixers for Inlaid Linoleums.

Paint Grinders and Mixers for Printed Goods.

be thrown over it. These precautions are particularly desirable in this location because the ever-present dust presents an unusual fire hazard. The advantages of the squirrel-cage induction motor are obvious.

These motors operate at constant speed, and are controlled by auto-starters. A meter in the power-supply of each motor enables the miller to tell at a glance when the stones need resetting, since any failure of the feed or wear of the stones shows up in a decreased current consumption.

From the stones, the cork is carried by screw-conveyors up to motor-driven bolting machines which sift out and reject all the coarser particles. Oxidized linseed oil and coloring matter is added, and the "mix" is ready for calendering.

At this point the inlaid process diverges from that which produces solid and printed goods. Taking the latter first, the mix is fed through chutes into the 6-roll train of a calender machine. This is driven by a 35-horsepower motor; the material is broken up as it emerges by a "scratcher" roll driven by a 10-horsepower motor. It is then fed down to the main calender rolls between which it passes with the burlap backing. These rolls are driven by a 75-horsepower motor; they are adjusted for various weights of goods by a 5-horsepower motor.

All these motors are of the squirrel-cage type except the main motor which on account of the heavy starting torque required and the necessity of adjusting the speed to suit the goods, is of the slip-ring type.

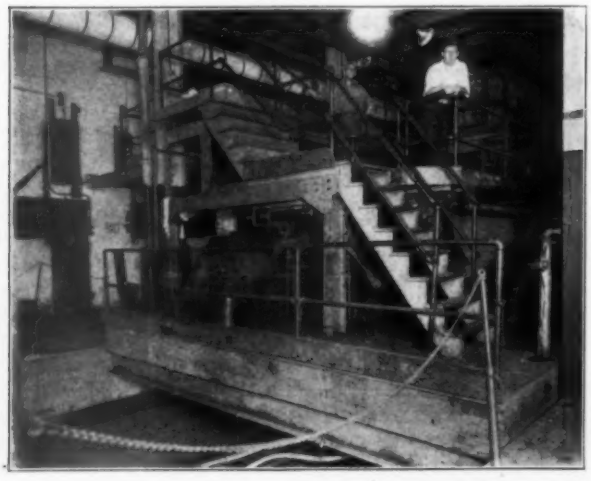
The linoleum then passes into one of the seasoning chambers or "stoves." In order to serve any of a dozen or more of these stoves, each set of calender machinery is set on wheels and is moved by a 10-horsepower motor along a track. All the motor and control equipment on the calenders is of Westinghouse make.

After a seasoning in the "stoves" the linoleum is drawn out and rolled up on a "beaming-out" machine which likewise passes up and down on tracks in front of the stoves. This has a 10-horsepower squirrel-cage motor, supplied through a plug connection and flexible cable. An overload relay on the motor prevents damage in case the long web of linoleum should stick.

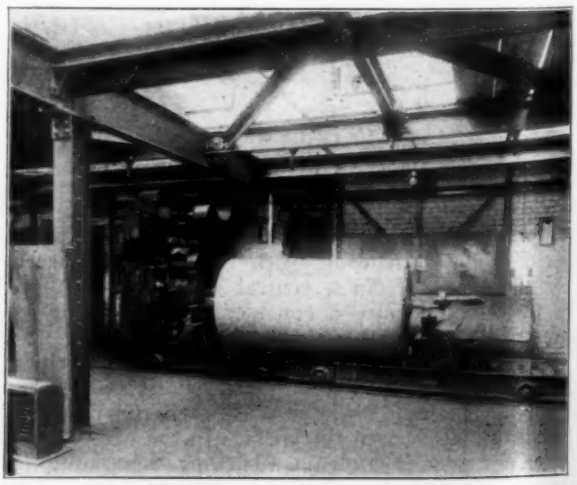
To compensate for the speed variation as the diameter of the rolls "grows," a Reeves variable-speed transmission is inserted in the reduction-train between the motor and the winding-shaft.

By a differential block and chain, the roll is transferred to the cutting table, where it is drawn through measuring rolls and selvage-trimming knives, and wound up into rolls containing commercial lengths of 64 square yards. This machine is driven by a 5-horsepower squirrel-cage motor.

When linoleum is to be printed, it is drawn direct



Calender Machine Showing Rolls.

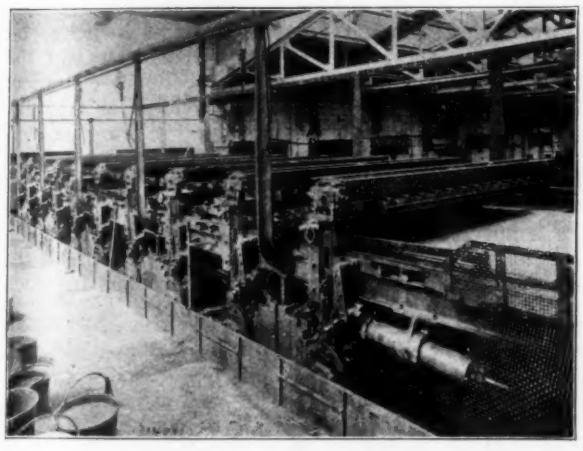


Beaming-out Machine, 10-Horsepower Motor.

from the stove to a printing machine driven by a 15-horsepower motor. This machine can likewise be traversed to the stove desired. After printing, the web goes back again to the stove for a few days' drying and further curing, when it is cut and trimmed as described above.

Mixing of the paints used in this process is carried on at the end of the light, airy press room. Pigments are first ground in oil, then shaded to the proper tone, and mixed with varnish by the machines shown. The 15-horsepower Westinghouse motor which drives these, as well as eight other grinders, is located out of sight and harm's way under the platform.

Inlaid linoleum involves an equally interesting process, but one which from its nature involves more hand labor. The cork, linseed oil and pigment are mixed in the "German Mixer" which operates precisely like a sausage-grinder. The mix is fed to a six-roll machine and scratcher roll as before, and then passes through calender rolls. The roll trains are driven by a 50-horsepower motor, while the scratcher roll is driven separately by a 15-horsepower motor. These machines turn out a sheet about 30 inches wide but without burlap backing. This is then cut by dies into pieces to make the desired design. The patterns are laid out by hand on iron plates, from which they are picked up by steel points projecting through a plate. This is then run over the working surface of



Machine for Printing Linoleum.

the machine and lowered into position over a sheet of oiled paper next to the previous installment. By withdrawing the pins, each block of composition is left in its place, and only a little smoothing is necessary to make the joints even. After each set is added, the whole moves along about 18 inches. Eventually the burlap backing is laid on, and the whole passes under a powerful hydraulic press which compacts it thoroughly. The oiled paper is then stripped off and the material is put in a "stove" to cure.

In the Armstrong plant there are about 3200 horsepower of motors installed, practically all of which were made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. Power is purchased from the Edison Electric Company of Lancaster as 440-volt, 25-cycle, 3-phase, alternating current, the total consumption being about 330,000 kilowatt-hours per month. For a plant such as this, electric motors served by central-station lines have been found to give the maximum of convenience and output at a minimum cost for operation and repairs.

NEW 92,500-HORSEPOWER HYDROELECTRIC PLANT FOR SPAIN.

First Two Units in Operation.

In a recent issue of the ELECTRICAL REVIEW, giving an account of a large hydroelectric plant being erected in Spain, in gathering the data some misstatements were made and it is therefore herewith reprinted with changes noted as received from the engineers on the ground.

G. W. Caldwell, of Kearny & Caldwell, consulting engineers of New York City and Barcelona, Spain, is in charge of the erection of a dam and hydroelectric plant situated at Camarasa, near Barcelona, Spain. It is stated that it will take at least two years to complete this big plant for the Ebro Irrigation & Power Company, which will have the largest dam in Europe. The Ebro Irrigation & Power Company is owned by the same British syndicate that was headed by the late Dr. F. S. Pearson, who lost his life in the Lusitania disaster. This syndicate owns the big irrigation system of the Medina Land & Irrigation Company situated near San Antonio, Tex., embracing 60,000 acres of land. It owns a large irrigation property in western Texas where the water supply is obtained from shallow wells by means of more than 100 pumping plants. Among its other extensive holdings is the largest box factory in the world, located at El Paso. Its investments in Mexico embrace a great hydroelectric plant at Necaxa with a transmission system that runs to the City of Mexico, Puebla and El Oro; the electric light system of the capital of Mexico, and the extensive system of electric tramways of that city, as well as of Puebla. In northwestern Mexico the syndicate owns 3,000,000 acres of timberland, which is penetrated by the Mexican Northwestern Railroad, also one of its properties.

The dam at Camarasa, near Barcelona, which is being constructed under the direction and management of Mr. Caldwell, is of concrete and measures 700 feet in length and 330 feet in height. It has a thickness of 230 feet at the base and 14 feet at the top. The reservoir formed by this structure will be 15½ miles long and 3¾ miles wide. The plant is to consist of five units of 18,500 horsepower and is the third one of the system which supplies power to Barcelona and the adjoining factory towns. The first two plants, consisting of 56,000 and 36,000 horsepower respectively, are already in operation and have done a great deal to relieve the power situation in the Barcelona district, where coal is selling from $40 to $65 a ton and hard to get at that. Enormous quantities of American construction materials are being used in the work and C. H. Kearny, of Kearny & Caldwell, recently spent some time in the United States looking after details relating to this project. The engineering force and many of the skilled laborers are said to be Americans.

Northern Wisconsin Hydroelectric Power.—Ashland Light, Power & Street Railway Company, Ashland, Wis., has under construction a power plant on the boundary line between Michigan and Wisconsin, at the mouth of Montreal River, estimated to cost $100,000. It is intended to connect the plant with the company's Ashland-Mellen-Ironwood line. An electric road is to be built from a point on Montreal River to Ashland, crossing Bad River reservation. The falls along this section of Montreal River make a descent of 1000 feet in a distance of 50 miles.

Cedegolo Station of the Adamello Power Development in Italy

Description of the Second Hydroelectric Station of a Group Supplying Power to the Italian Arsenals

By C. A. TUPPER

A PREVIOUS article, printed in the ELECTRICAL REVIEW November 10, described the upper works of the Adamello power development centering at the Isola station. The lower works, at Cedegolo, were designed to take the combined flow of the discharge from Isola, the diversion through a conduit from the Salarno River, the water from the main stream of the Poglia River and also the overflow from the Lago d'Arno through its natural outlet, the Poja d'Arno.

The water-race, 2.8 miles long, leading to the lower power works, is partly conduit and partly tunnel; a trolley line runs alongside it, up which the building materials, pipes and the machines for the Isola station were hauled by an electric locomotive. There is an overflow and waste sluice at about the middle of the race. A balancing reservoir of 917,800 cubic feet capacity adjoins the penstock chamber of the Cedegolo station, and is thus able, in case of need, to supply independently the turbines with 131 cubic feet per second for two hours.

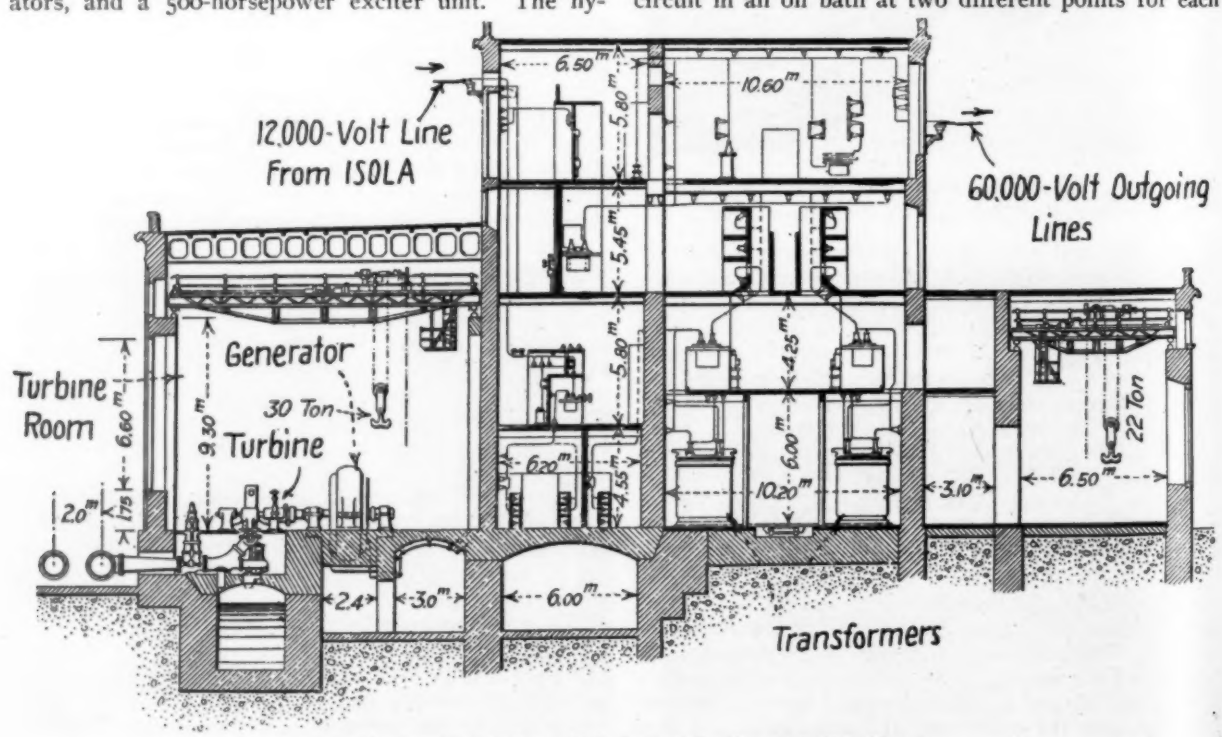
From the penstock chamber two pipe lines, each of 39.4 inches diameter, descend in a straight line to the Cedegolo power house, on the left bank of the Poglia. The generating room contains five 4500-horsepower hydraulic turbines, coupled to three-phase, 40-cycle, 12,000-volt, 420-revolution per minue generators, and a 500-horsepower exciter unit. The hydraulic features of this station closely resemble those of the Isola station already described.

ELECTRICAL FEATURES OF CEDEGOLO STATION.

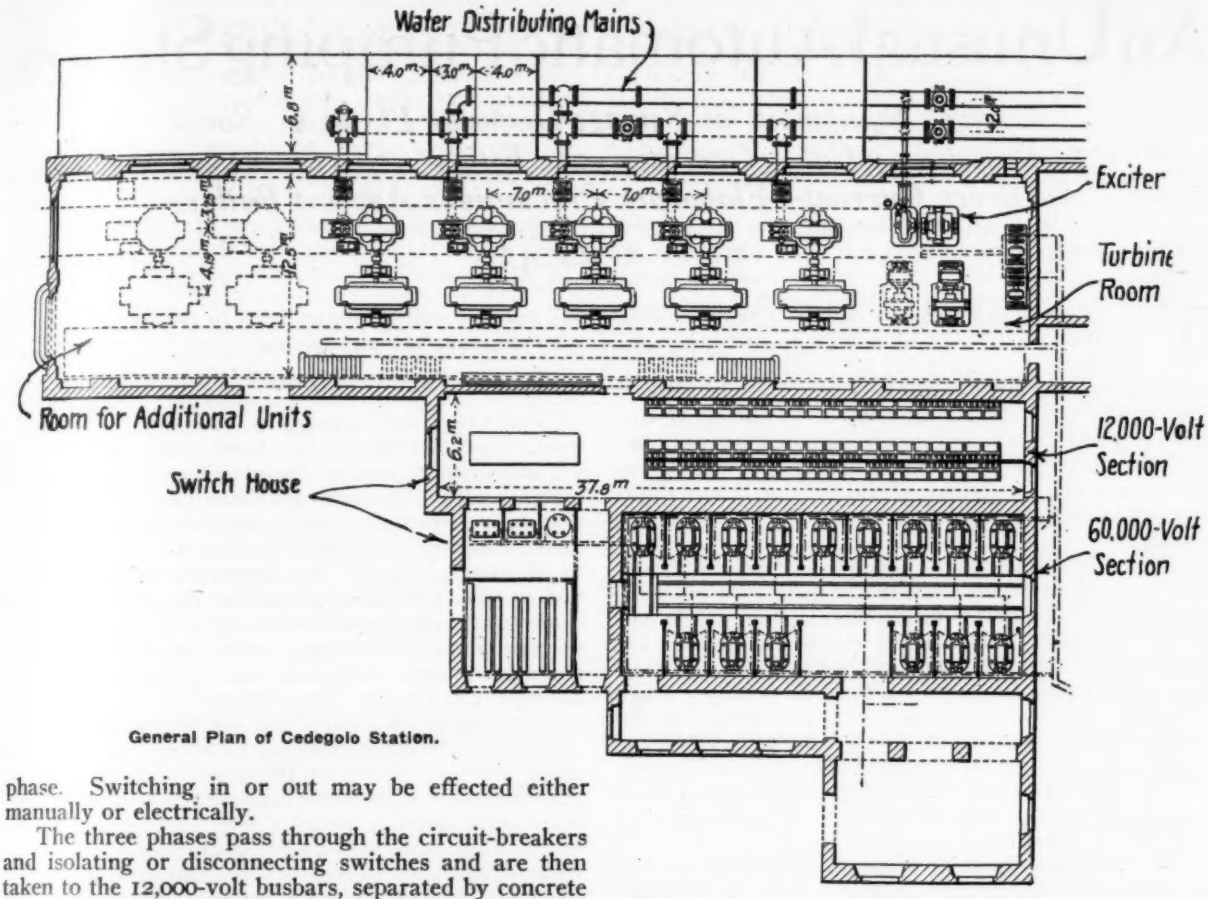
This central station includes a large switching and transformer plant, where the current is stepped up to 60,000 volts for the long-distance transmission system. There are 15 single-phase, oil-filled, water-cooled transformers of 2700 kilovolt-amperes each in two rows of separate cells in the back of the station.

The central part of the building is occupied by the switchgear, which is so designed that it can combine for transmission the energy generated in this station with that supplied from the Isola station. The apparatus occupies the basement and four stories. The 12,000-volt busbars are on the ground floor, with the oil switches for the generating units on the first floor above, the 60,000-volt busbars and line switches on the second floor and the lightning arresters on the third, as partially shown by the sectional elevation. Protective apparatus at the top provides for the outgoing lines to Milan and those coming in from Isola.

The single-phase cables coming from the alternators are laid in a spacious underground passage and run into the 12,000-volt busbar chamber, where they are connected to the oil switches. The switches are three-phase, with instantaneous release, and break the circuit in an oil bath at two different points for each



Cross-Sectional Elevation. High Central Portion is Switch House.



General Plan of Cedegolo Station.

phase. Switching in or out may be effected either manually or electrically.

The three phases pass through the circuit-breakers and isolating or disconnecting switches and are then taken to the 12,000-volt busbars, separated by concrete partitions. As two working systems are required for the station, two sets of busbars are provided, which, if necessary, can be connected to form ring mains. From the busbars the connections rise to the first floor above, after passing through the 12,000-volt transformer oil switches, which are mechanically connected to the corresponding switches for the 60,000-volt side, so that any transformer can be completely isolated in one operation. From the transformers the connections next pass to the 60,000-volt busbars on the second floor above, then are taken through the line switches and finally to the lightning arresters and outgoing cables. On the top floor, but on the opposite side, four 12,000-volt lines from Isola station enter the building, and the regulation for parallel operation of the two stations is carried out on the low-voltage side.

For the current used in the plant itself and vicinity there are two three-phase oil-filled water-cooled transformers, only one of which is required in service, the other being held in reserve. Here current from the 12,000-volt busbars is stepped down to 220 volts. The whole of the installation is controlled from three benchboards on a raised platform, one for the generators, one for the transformers, and one for the lines. The auxiliaries are controlled from a vertical 12-panel switchboard on the generator floor.

60,000-Volt Transmission System.

The high-tension system of the 74.6-mile transmission to Milan consists of four lines, of three wires each, carried on separate towers. The lines are 39.4 feet apart; the normal height of the steel towers is about 65.6 feet, and the usual span between them is 607 feet. The latter is, in places, increased to 656 feet. Experience shows that in spite of their greater height and strength the smaller number of towers and the fewer insulators on this line give a very considerable saving over the older arrangement with shorter spans. This system throughout is typical of those of modern construction in Italy and in general conforms to good standard practice the world over.

The National Association of Corporation Schools.—The urgent need for development of the most efficient and intelligent service on the part of employees of industrial, commercial and utility corporations has led the National Association of Corporation Schools to publish a booklet on its work. It was organized about five years ago with 18 members; now it has 105 members—all corporations engaged in such varied activities as central-station service, electric and steam-railway transportation, steel production, shipbuilding, telephone service, gas supply, manufacturing, insurance, etc. The association's work is to help its members in the specialized education of their employees, also to promote their health, safety and general welfare. It has aided in the establishment of schools or courses for traveling salesmen, retail salesmen and saleswomen, mechanics in almost every line, accountants, office workers of every class, and even common laborers. The president of the National Association of Corporation Schools is J. W. Dietz, of the Western Electric Company, Inc.; the executive secretary is F. C. Henderschott, of the New York Edison Company. Arthur Williams, general commercial manager of the New York Edison Company, and food administrator of New York City, is chairman of the association's policy and finance committee.

An Unusual Automatic Pumping Station

Control Equipment of Sewage-Disposal Plant at South Pasadena, Cal., Operates on Either Alternating or Direct Current—Elaborate Precautions Against Failure

By G. R. RADLEY

THERE are certain classes of power requirements in which continuity of service is extremely important. In such cases an analysis of the possible causes for interruption to power supply, and of the devices used for transmitting and controlling this power, leads to an apparently complicated solution, and the accompanying illustration of the installation for caring for the sewage of the City of South Pasadena, Cal., may serve as an exceptionally interesting example.

The rate of disposal of sewage is of necessity subject to wide variations, and it is natural, therefore, to provide for automatic means of starting the pumps when the level in the settling chambers becomes too high, and to stop the pumps when the level is reduced to a safe condition. But a pump which is large enough to cope with the maximum conditions would be unsatisfactory in that it would have to be started and stopped at undesirably frequent intervals, and in case trouble developed with this single pumping unit, there would be serious criticism of the lack of foresight of the health authorities, to say the least.

It, therefore, becomes desirable to provide at least two pumping units, with control devices so arranged that as the level of the water in the settling chamber rises, unit No. 1 will be started at a certain height, and in case the capacity of this pump is not sufficient to keep the level from increasing, then the second pump is automatically started, giving the combined capacity of the two pumps working simultaneously. The float switches are adjusted so that the pump which started second is the one which stops first. This results in the wear being concentrated almost entirely on the first equipment, and in order to permit equalization of the wear, means are provided to permit the relative interchange of the connections between the two float switches, and the two motors driving the pumps, it merely being necessary for the attendant at periodic intervals to shift this switch from one position to the other.

Long-distance electrical transmission lines have been greatly improved in regard to their freedom from interruption of service, but there are still cases in which unforeseen combinations occur, and, where the health of the community is dependent upon the continuance of operation of the particular piece of apparatus, it may well be considered the part of wisdom to provide insurance against an interruption to the source of power.

In the example before us, the consulting engineer has provided duplicate sources of power, one being alternating current supplied as 220 volts, 3 phase, 50 cycles, the other being direct current at 600 volts. It is the intention to utilize the alternating current as the regular means of operation, but a complete system of automatic transfer to the direct-current source has been provided, so that even though an attendant is not present at the time the failure of the alternating current occurs, the machinery will continue to operate and will automatically transfer back to the regular source, when it again becomes normal.

Method of Making Automatic Transfer.

The means for securing this automatic transfer is the C-H phase-failure relay shown in the center of the left-hand upper panel of the switchboard. This relay, together with all control equipment used in the installation, was furnished by the Cutler-Hammer Manufacturing Company, Milwaukee. The relay is responsive to all three phases of the alternating-current supply, and in case one phase should be disconnected, or in case the line voltage should decrease below 70 per cent of normal, it will at once cause the opening of the magnetic switch completing the circuit to the alternating-current motor. The pilot contacts on this switch will in turn at once cause the starting of one or both of the direct-current motors by means of the automatic starters shown at the lower left-hand corner and the lower right-hand corner, respectively, of the lower end panels. These direct-current starters are of the fixed time-element accelerating type, this being desirable because of the fact that the load which may exist is subject to variation through wide limits. One extreme may be that when the pump has not had time to have fallen much below its normal speed, as would be the case with a sudden and complete failure of the alternating-current supply. The other extreme of load would be that when the first start of the equipment was being made, and the bearings may not have yet become supplied with oil, or at times when new packing has been applied, and be perhaps set up tighter than necessary. With this type of acceleration the resistance will be cut out of the armature circuit in a given time, independent of the load conditions, and the motor will be forced to take as much current as is necessary to overcome the resisting torque.

It is interesting to note that in this installation the consulting engineer felt that each of the sewage-disposal pumps should be provided with both an alternating and direct-current motor, these motors both being coupled together so as to form a complete unit on a common bedplate. In the illustration the alternating-current motor is almost hidden by the somewhat larger direct-current motor in the foreground.

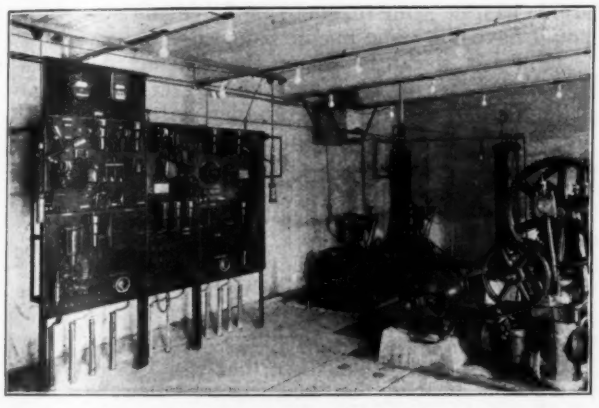
By the use of both types of motor with complete control equipment, it will be noted that a complete separation of the two systems of electrical power supply is carried directly through to the pumps themselves, the only element not being duplicated being the silent chain transmission from the single motor pinion to the pump.

Duplicate Float Switches.

It will be noted that at either end of the switchboard is a chain operating a double-pole float switch. One blade of each float switch is in the alternating-current control circuit, and the other blade is in the direct-current pilot circuit. The two-pole, double-

throw switch mounted in a horizontal position on each of the end panels serves to select as to whether the normal operation shall be by alternating current with automatic transfer to direct current, or shall be entirely on the direct-current system. These float switches are operated by means of chains connecting with an open float in the settling basin. In the winter time ice may form and interfere with the free operation of these open floats. A sheltered chamber has, therefore, been provided, which connects with the main basin, and in this special chamber another set of float switches with electrical contacts paralleling those of the chain-operated floats have been provided.

As a further precaution against the failure of the automatic means of controlling the pumps, switches have been provided for transferring both the direct-current and the alternating-current motor of each pumping unit to permit of manual operation. This is accomplished by the three-pole horizontally mounted switch having 600-volt spacing in the blades, and mounted on the two end panels. The alternating-current motor is of 6-horsepower rating, squirrel-cage type, which may be started by throwing it across the line. The direct-current motor of the same rating, 600 volts, however, requires the use of a resistance-type starter, which is mounted back of the board and operated by means of the handwheel located on the face of lower panels.



South Pasadena, Cal., Sewage-Disposal Plant Pumping Equipment. Automatic Motor Control and Motor Equipment Is in Duplicate for Operation on Alternating-Current or Direct-Current Service.

In order to provide against interruptions by blown fuses, inverse-time-element overload relays are used instead, thus permitting of even extreme overloads being carried for a short time, but guarding against the burnout of the motor should abnormal conditions result in overload in excess of 25 per cent above normal being applied continuously. These overload relays are provided with a bell-ringing attachment to call the attention of an attendant in case of their operation.

The switching arrangement for changing the sequence of starting of the two pumping units is located on the right-hand panel, and consists of a disk of insulating material, carrying on its underside pencil contacts, which adequately handle small currents used for both alternating-current and direct-current automatic starters, but which have no exposed contacts which might give a careless operator a shock from the 600-volt system.

COMPRESSORS CONTROLLED BY PRESSURE REGULATORS.

In connection with the disposal of the sewage, compressed air is required for the aeration of the sludge, and the center panel of this switchboard controls the two units, which are provided for this purpose. In this case one compressor is operated by an alternating-current motor, and the other is operated by a direct-current motor, each being of 5-horsepower rating. The starting and stopping of these motors is accomplished automatically by means of diaphragm-type pressure regulators mounted back of the switchboard. The regulator for the alternating-current motor is set to work with limits slightly higher than that connected with the direct-current motor, consequently the normal operation will be from the alternating-current system, the other pump and source of current serving as a complete emergency unit which automatically comes into service, if for any reason the first unit does not maintain the desired pressure.

The specifications for this interesting installation were drawn up by H. Hawgood, consulting engineer of Los Angeles.

A Well-Equipped Electrified Woodworking Plant.

A woodworking factory of over 100 machines, each driven by an individual motor, may be seen at the plant of the S. E. Overton Company, South Haven, Mich. There is not a line shaft, nor a group drive in the entire works. The products of the factory are stairway posts, piano benches, piano legs, Victrola parts and general scroll work in walnut, oak, mahogany and other woods. The 100 motors, of a combined capacity of about 200 horsepower, are all General Electric, alternating-current machines, and in most cases they are belt-connected to the tools which they drive. The largest motor is of 25 horsepower; there are 50 of one-half horsepower each for operating that number of spindle carving machines. Others of two and three horsepower are belt-connected to cut-off saws, swing saws, planing machines, buzz planers, groovers and shapers, band saws, and a sander for finishing. In the machine shop are two motors for shop tools.

The company's power plant, occupying a part of a separate building, contains two boilers of 100 horsepower each, the fuel for which comprises mill refuse and coal. The steam produced drives an Allis-Chalmers 225-horsepower Corliss engine, connected by rubber belt to an Allis-Chalmers alternator, operating at 245 volts and 720 revolutions per minute, as a 3-phase, 60-cycle machine, rated at 361 amperes.

Some additional current for lighting is purchased from the municipal plant. Besides general office and factory lighting, each machine is supplied with an individual lamp. The other uses for steam are for heating the buildings, and for seven dry kilns.

Telephone Companies in Kentucky Permitted to Consolidate.—At the recent election in Kentucky an amendment to the state constitution was adopted eliminating the positive constitutional provision against consolidation of competing telephone companies. The constitution was adopted in the days when competition was considered a first essential to public service and this particular section has resulted in continuation of dual telephone services in numbers of Kentucky towns, with profit neither to the companies nor to the subscribers. It is understood that the Bell Telephone Company was one of the leading workers for the new provision, in which the independent companies concurred. It will be followed by consolidation of many dual systems.

The Magnetic Circuit—I

Simple Explanation of the Laws of the Magnetic Circuit—Definition of the Fundamental Terms and Derivation of the Formulas Showing Their Relation

By TERRELL CROFT

This is the first section of an article that will appear in five parts. It gives for the non-technical reader who is familiar with the elementary principles of electric circuits a simple explanation of the phenomena and laws of magnetic circuits, which are used so extensively in the electrical industry. This first section is quite elementary because it is necessary to have a thorough grasp of the fundamental magnetic facts. The remaining sections will complete the discussion of magnetic laws, particularly as they relate to iron, the most used magnetic material, and give an excellent introduction to the design and calculation of simple magnetic circuits.

THE laws of the magnetic circuit are similar to (but not the same as) those of the electric circuit. Thus, it will become evident as the reader proceeds that the same general underlying principles which govern phenomena of electric circuits also govern those in magnetic circuits. The reader will find that the *flux*—lines of force—in a magnetic circuit is analogous to the current in an electric circuit, and that the *magnetomotive force*—the force to which the flux in a magnetic circuit is due—is analogous to the electromotive force, or voltage, of an electric circuit. Furthermore, he will learn that just as electric circuits have a property which is termed resistance, so every magnetic circuit has an analogous property which has been termed *reluctance*.

Hence, instead of having to become familiar with a new and distinct set of principles and ideas in order to understand magnetic circuit phenomena, the reader will merely have to apply to a new group of quantities and units the same old general principles which he has already learned in connection with the study of the electric circuit. Understand, however, that the units and quantities for magnetic circuits *are not* the same as those for electric circuits, but they are analogous and the same essential underlying general ideas apply for both magnetic and electric circuits.

Acknowledgment is due to Prof. V. Karapetoff for proposing a logical and rational development of the theory of the magnetic circuit and for placing magnetic circuit theory on a firm rational engineering basis. The treatment given in this series of articles is based on that outlined by Karapetoff in his most excellent, but rather mathematical, treatise on "The Magnetic Circuit."

Example of Relations in a Magnetic Circuit.

Assume that suitable instruments, which cannot be described here, are arranged somewhat as shown in Fig. 1. By reading the instruments and making certain calculations one can readily determine the flux generated by the toroid or circular helix when it has an air core as at *I*, and also when it has an iron core, as at *II*. The same current is assumed to flow in the helix in both instances. Also the toroid of *I* is of the same diameter and has the same number of turns of wire as that of *II*. It is obvious then that each of the toroids has the same magnetizing force and apparently should have the same magnetizing effect.

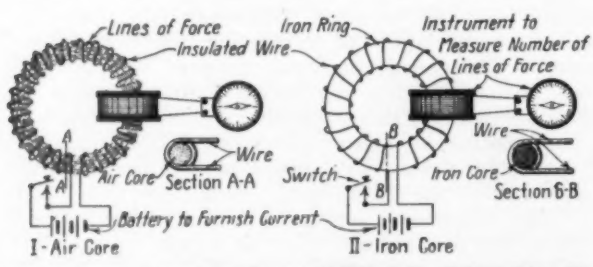


Fig. 1—Simple Arrangement of Apparatus for Determining the Permeability of Iron.

However, it can be shown that the flux developed in the iron core of *II* is very much greater than that in the air core of *I*. In fact, under certain conditions and with the same current flowing in *I* and *II*, assuming the cross-sectional area of each of the cores to be one square inch, a flux of 23 lines will be established within the air core of *I*, but when an iron core is inserted in the toroid, as at *II* and with the same current flowing, the flux then developed within the toroid will be 40,000 lines. That is, by the insertion of the iron core, the flux has been increased 1739 times. The natural inference is that air offers a much greater opposition to the development of magnetic flux in it than does iron. That is, the "magnetic resistance" of iron, or what is known as its reluctance, is much less than that of air.

Magnetomotive Force and Ampere-Turns.

Magnetomotive force (often abbreviated m. m. f.) is that force or agent due to which flux (lines of force or magnetism) is set up in a magnetic circuit. In an electric circuit there must be an electromotive force impressed on the circuit before a current can be forced to flow in it. Similarly, in a magnetic circuit there must be a magnetomotive force before there can be flux. Magnetomotive force is the cause, flux is the effect. Thus, it is evident that magnetomotive force in a magnetic circuit is analogous to electric pressure, voltage or electromotive force, in an electric circuit.

To produce an effect with any medium—water,

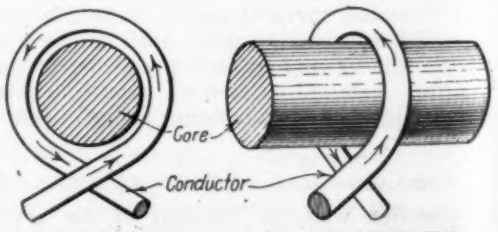


Fig. 2—Diagram of One Electromagnetic Turn.

air, electricity, or magnetism—a force, push, or pressure is always necessary. With the electric circuit this pressure is called electromotive force or voltage and with a magnetic circuit it is called magnetomotive force.

A *turn* in electromagnetic parlance implies one wrap of a conductor around a core which may, in the

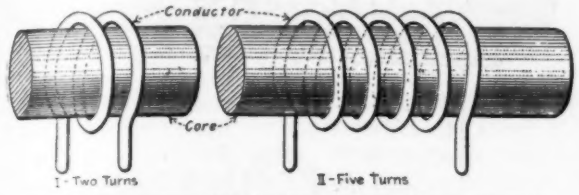


Fig. 3—Illustrating the Meaning of the Term "Turn."

case of a solenoid, be an air core, or, in the case of an electromagnet, an iron core. Fig. 2 shows one turn around a core and in Fig. 3, diagrams *I* and *II* show, respectively, two turns and five turns around a core.

The practical and rational unit of magnetomotive force is the *ampere-turn*. That is, the ability to produce a flux of lines of force in an electromagnetic circuit is determined by the number of ampere-turns magnetizing that circuit. If the number of lines of force produced by a given helix be ascertained mathematically or experimentally, as in Fig. 1, it will be found that the number of these lines is, in the last analysis, proportional to just two factors: (a) the current, in amperes, flowing in the helix, and (b) the number of turns in the helix. The voltage impressed on the helix, and the size of wire used in—that is, the resistance of—the helix have nothing to do with the situation except indirectly. The flux developed within a coil like that of Fig. 1, *I*, will not change if the current (amperes) and the number of turns in the "exciting" winding so vary that their product remains the same.

For example, if a current of 20 amperes circulates around a coil of 5 turns, the magnetomotive force of that coil in ampere-turns is $20 \times 5 = 100$ ampere-turns. Also, if one ampere circulates in a coil of 100 turns, the magnetomotive force of that coil is $1 \times 100 = 100$ ampere-turns. If 10 amperes circulate in a coil of 10 turns, then again the magnetomotive force developed by this coil is $10 \times 10 = 100$ ampere-turns. If 50 amperes circulate in a coil of two turns, the magnetomotive force of the coil is $50 \times 2 = 100$ ampere-turns.

In Fig. 4, each of the three helixes shown has 16 turns and a current of 5 amperes is flowing through each helix. Hence, the ampere-turns of each is 5 amperes $\times$ 16 turns = 80 ampere-turns, regardless of the size of the coil.

A given number of ampere-turns will produce a flux comprising more lines of force in a short magnetic circuit or in one of large cross-sectional area than in a magnetic circuit which is long or of small cross-sectional area. But, for a given magnetic circuit, the greater the number of ampere-turns, the greater will be the flux produced.

Where very large magnetomotive forces are involved, as for example, in the magnetic circuits of electrical machines, it is customary to specify these magnetomotive forces in kiloampere-turns. One kiloampere-turn is equal to 1000 ampere-turns, hence, 20,000 ampere-turns equals 20 kiloampere-turns.

Why magnetizing force is proportional to the product of amperes and turns may be evident from a consideration of Figs. 5, 6 and 7. Consider the helix of square wire containing 20 turns wound around a core as shown in Fig. 5. The magnetomotive force of this helix is 20 ampere-turns. The turns of the helix are supposed to be insulated from one another and from the core. With a current of one ampere flowing in this helix, it is obvious that it will produce a certain magnetizing effect in the core.

Now, assume that the helix is divided into two sections, S_1 and S_2, as shown in Fig. 6. Furthermore, assume that each turn is cut through with a fine saw. The width of the cut is exaggerated in Fig. 6 so as to bring out the details clearly. Now, assume that the turns are connected in parallel, as shown, by the very-low-resistance conductors, *AB, CD,* etc. When connected in this way, each of the two sections, S_1 and S_2, really constitutes a single turn around the conductor. Now, it is evident that if a current of 10 amperes be forced through each of the sections, the ampere-turns of the arrangement will be 2 turns $\times$ 10 amperes = 20 ampere-turns, the same magnetomotive force as with Fig. 5. Furthermore, it is also apparent that in each ring conductor around the bar, a current of one ampere will flow, so that the magnetizing effect of the arrangement in Fig. 6 must be the same as that of Fig. 5.

Also, if the 20 turns are all connected in multiple, as shown in Fig. 7, and each one opened with a saw cut, the arrangement is equivalent to one turn around the conductor. With 20 amperes forced through this one composite turn, its magnetomotive force would be 20 ampere-turns. However, just one ampere would flow in each elemental turn, and the magnetizing effect would, obviously, be the same as that with the coils of Figs. 5 and 6.

The formulas for the ampere-turn are readily stated from what has preceded, thus:

(1) $M = I \times N$ (ampere-turns)
(2) $I = M/N$ (amperes)
(3) $N = M/I$ (turns)

wherein, M = magnetomotive force in ampere-turns; I = current, in amperes, flowing in the winding under consideration; N = number of turns in the winding under consideration.

The following examples will illustrate the use of these simple formulas. If a certain solenoid is developing a magnetomotive force of 1200 ampere-turns,

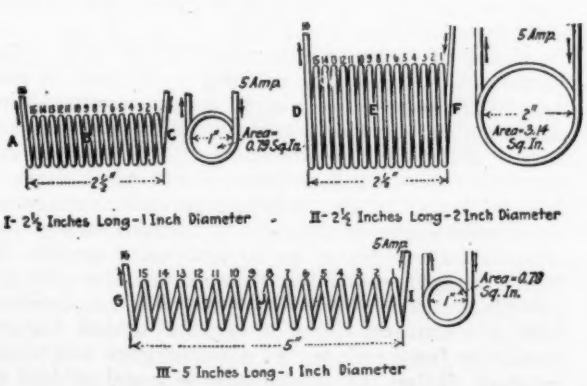


Fig. 4—Diagram Showing That the Size or Form of a Helix Does Not Necessarily Change Its Number of Ampere-Turns.

and there are 60 turns in the solenoid, the current in that solenoid would necessarily, from equation (2), be: $I = M \div N = 1200 \div 60 = 20$ amperes. Again,

assume that it is necessary to produce a magnetomotive force of 2600 ampere-turns, and that only a series circuit which always carries a constant current of 6.6 amperes is available. How many turns would a solenoid of this circuit have to contain in order to develop the required magnetomotive force? For the solution, substitute in equation (3) $N = M \div I = 2600 \div 6.6 = 394$ turns.

Magnetic Flux and Lines of Force.

Flux has been referred to in a preceding paragraph. Flux is the total magnetism or total number of lines of force in the magnetic circuit passing through a cross section taken at right angles to the direction of the lines of force. Just as in a series electric circuit the current flowing in every part of the circuit is the same, likewise in a series magnetic circuit, the total flux flowing in every part of the circuit is the same, at any part of the complete circuit. It should be noted, however, that since there is no "insulator" for magnetism, it is impossible to confine flux in a definite path in the same way that an electric current may be confined in a conductor. For this reason, it may be difficult in many cases to ascertain the flux at a certain cross section of a magnetic circuit because of the difficulty of accurately defining the extent of the cross section. The

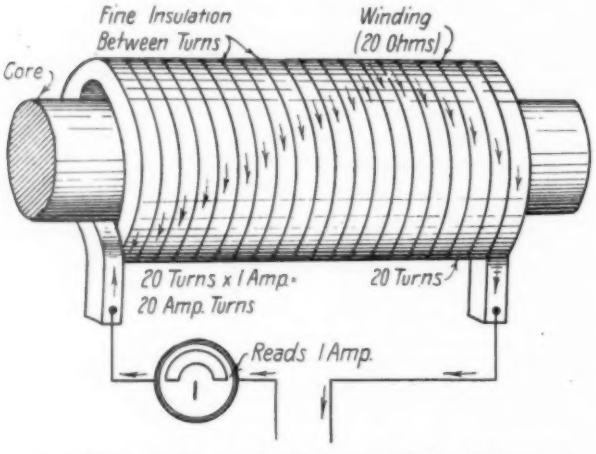


Fig. 5—Twenty Turns and One Ampere Makes 20 Ampere-Turns.

cross section may include both magnetic and non-magnetic materials.

A line of force, or a *maxwell,* will now be defined quantitatively. The line of force is the unit of magnetic flux, just as the ampere is the unit of electric current. The definition which will be given is based on the observed experimental fact that when a conductor is moved across a flux so as to cut through the lines of force, an electromotive force or voltage will be induced in the conductor. A magnetic flux of 100,000,000 lines of force—or 100,000,000 maxwells—has been arbitrarily defined as that uniform flux which, if a conductor is moved through it so as to cut across the lines at a uniform speed of just one second, the electromotive force induced in the conductor will remain constant during the second and be equal to just one volt. Hence, *a flux of one line is that flux which would induce an electromotive force of* $\frac{1}{100,000,000}$ *volt in a conductor moved through it in one second.*

The following definition from Karapetoff's "The Magnetic Circuit" which really has the same meaning

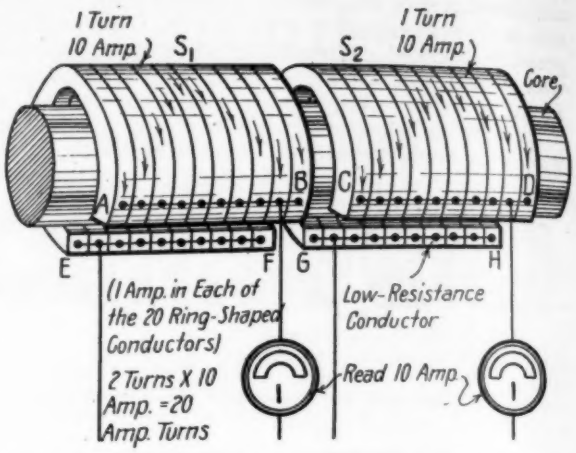


Fig. 6—Two Turns and Ten Amperes Makes 20 Ampere-Turns.

as that above given, is worth noting: "A flux through a turn of wire changes at a uniform rate of 100,000,000 lines per second when the electromotive force induced in the turn remains constant and equal to one volt."

A kiloline is equal to 1000 lines of force. A megaline is equal to 1,000,000 lines of force. These terms are occasionally used for convenience.

Magnetic Reluctance.

Reluctance (how to compute reluctance will be explained later) is the name which has been given to that property of materials that opposes the creation of magnetic flux in them. Reluctance, then, indicates the "difficulty" encountered in creating magnetic flux in a material. With electric circuits, the property of substances which opposes or limits the flow of current in them is called resistance. The analogous property of substances in magnetic circuits is reluctance. In electric circuits nearly all substances have different resistance properties, some offering little, and others great opposition to the establishment of electric currents. In magnetic circuits nearly all substances except the magnetic metals have practically the same reluctances. Iron has a relatively low reluctance, while air and all other non-magnetic materials have the same and a relatively high reluctance. Numerically, reluctance is the reciprocal of permeance, which will be defined later.

The practical unit of reluctance is the *rel.* A mag-

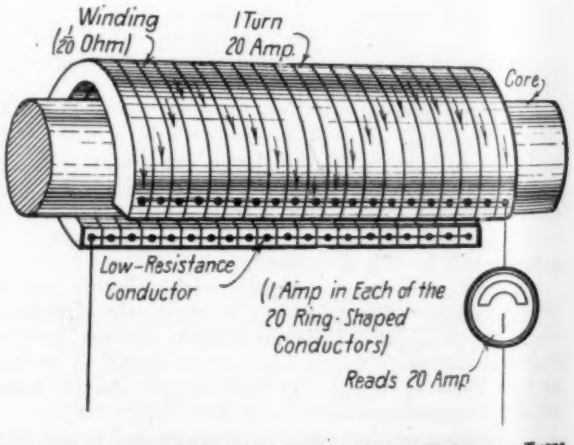


Fig. 7—One Turn and Twenty Amperes Makes 20 Ampere-Turns.

netic circuit has a reluctance of one rel when a magnetomotive force of one ampere-turn generates in it a flux of one line. The rel is analogous to the ohm. Just as the ohm is the resistance of a column of mercury 41.85 inches long and 0.00049 inch in diameter, the rel is the reluctance of a prism of air, or any other non-magnetic material, Fig. 8, 1 inch square and 3.19 inches long.

The reluctances of different materials may be determined by tests similar in general to the methods used in determining the resistance of substances.

The following are examples of comparative reluctances of different materials. The reluctance from *A* to *B*, Fig. 8, of a prism of air, wood, glass, or other non-magnetic material, 1 inch square and 3.19 inches long, is one rel. A bar of mild steel or wrought iron, 1 inch square and 460 feet long, has, under the most favorable conditions, a reluctance of one rel. A bar of cast iron 1 inch square and 50.7 feet long has, under the most favorable conditions, a reluctance of about one rel.

Reluctance is not always constant in magnetic materials, but it is in all non-magnetic materials. In magnetic materials the reluctance varies with the flux density, as will be further explained later. Variation of resistance with temperature is a somewhat analo-

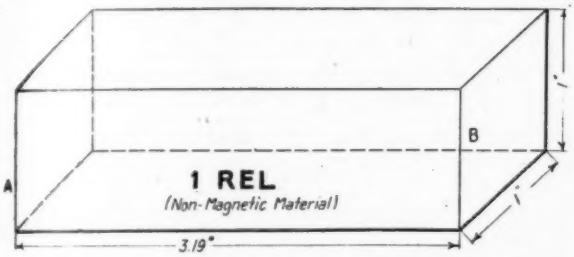


Fig. 8—Magnitude of the Rel or Unit of Reluctance. The Material is Air or Other Non-magnetic Substance.

gous condition. The greater the flux density in a magnetic material the greater (within certain limits) will be the reluctance of the material.

To be continued.

BLIND DOING THEIR BIT IN ELECTRICAL FIELD.

President of Crocker-Wheeler Company Inaugurates Winding Department for Blind.

Not even the blind are exempted from attempting to "do their bit" in helping to win the war. Dr. Schuyler S. Wheeler, of New York, president of the Crocker-Wheeler Company, Ampere, N. J., which company manufactures electrical apparatus, recently discovered that blind persons were very successful in the winding of wire coils for armatures and similar devices, including the insulation of the wires by wrapping them with tape. In telling of the work and how he discovered this useful occupation for the blind, Dr. Wheeler says:

"One day I was walking through the winding-room of our plant and I stopped to watch the work, much of which is done by women. There they wind the coils for armatures and similar apparatus, and as I watched the flying fingers of the workmen, the thought came to me that the fingers of the blind could do this work, and do it well.

"I wound coils myself years ago, and I know exactly what is required. I realized that I could do the work myself after some practice even if I were blindfolded. Finally I made up my mind that I had found what I was looking for—necessary work that could be done by the blind.

"This work consists of wrapping with tape the coils of wire used in the electrical machines. Millions of these wire coils are used and their number is growing each year. Wrapping or insulating them with tape is a kind of work very similar to basket-weaving and chair-caning, in that it does not require the use of machinery and depends solely on the touch of the fingers of the operator. The great advantage is that this work is staple, there is a large demand for it, and no difficulty is experienced in selling it.

"Six weeks ago I started our blind winding-room at No. 22 Park Avenue, Ampere, N. J., where our plant is located. We started with only a few blind persons; now there are nearly 20 working there, and three of them are women. They all had worked at manual trades before and took to the coil-winding very readily. Most of them have been blind all their lives, and their fingers are trained to such an extent that they do the work with ease and precision. We find the blind are slower and more cautious, and their work is actually more thorough and perfectly smooth. This is very desirable, for smooth, even electrical winding and insulating are very important. In fact, although they are slower than those with sight, their work is as good, if not better.

"The great thing, however, is that they can make a living. They are paid by the piecework system, and we find that they can make a living wage after a very few days. As they improve their earnings increase, and it will not be long before they are making fair wages, and, what is more, they will be worth every cent they get.

"Our little shop, which is entirely a private enterprise, is only the beginning. Those whom we have been able to teach will teach others, and before long the blind should be doing this kind of work all over the country. What is more, the success of our experiment will make the way clear for the authorities to take up the matter. Then the many war-blind will become of use to their countries and will cease to be a burden.

In England, in France, and the countries of our other allies men can be released from service with their respective armies and their work done in this line by the blind heroes. Furthermore, steady and remunerative employment will make these blind soldiers independent, and this is the greatest feature of it all, for there is nothing so pathetic as the dependent hero.

"Back and forth among the workers goes a forewoman from the regular shop who has become the instructor and friend of all. She gives out the material, inspects, accepts the finished product, and pays off. This is her first work for the blind, but she is an expert at their work, and, what is more, is an enthusiast. It is a pleasure to watch her capable hands guide the willing fingers, and it is remarkable how little training she has to give.

"It is expected that blinded soldiers from the armies of the allies will soon be receiving instruction at the 'Double-Duty Finger Gild.' When these are proficient they will return to their various countries and carry on the work of making the blind self-supporting by instructing others of the thousands of war-blind."

Editorial Comment

The Growing Need For Men

THE response of Americans to our country's call to war has been magnificent. More men have volunteered their services than can as yet be placed. But the activities and requirements of the Government are increasing at a tremendous pace as we take our part in the conflict. The need for men in positions under private employ, but actually serving the public at tasks vitally connected with the war, will soon exceed the supply. It is essential, so far as the electrical industries are concerned, to prepare more adequately in future to meet this demand in a way that will cause the least possible disturbance to orders under contract. Experience in other countries shows that ordinary methods of procuring labor, in all classes from unskilled to the most highly trained professional men, will soon prove inadequate. A council of men prominent in all branches of electrical work, including railway, light and power operations; telephone, telegraph and signal service; jobbing, manufacturing, etc., might prove of great value in this emergency, and either Pittsburgh or Chicago would be a good central point at which to hold it.

What do our readers think of the suggestion? The ELECTRICAL REVIEW will be glad to act as a clearing house for the interchange of views on this or any other plan proposed for effectively meeting the situation.

In this connection it may also be said that a clear and definite official statement of labor policy on the part of the Government would go far towards reducing labor troubles to a minimum. It would remove the incentive for the reckless calling of strikes for the closed shop in the mere hope that Government interference in assistance of such strikes would be forthcoming. It would check and discredit the unauthorized and misleading statements of agitators and of certain minor Government agents who come in contact with war work. It would remove the misconception on the part of the union man as to the attitude of the Government and point clearly for him the path of patriotic duty. Last, but not least, such a statement of policy would settle the doubts and hearten the resolutions of a vast majority of loyal workmen who have remained out of labor organizations from choice, and who hesitate to seek employment on war work, including shipbuilding, so long as it remains a storm center of conflict over questions of union control. If it be definitely understood that the present status shall be observed so far as the closed and open shop is concerned, that is, that war work shall not be made the lever either to open a closed shop or to close an open shop, the field of possible labor controversy will at once be greatly reduced. Such a governmental statement of policy would make clear to every one engaged in war work and its equivalent, whether employer or employee, exactly where he stands, and would be among the most effective possible means of making available for such work the full labor supply of the country, both union and non-union.

Water-Power Development Awaits a Far-Sighted Congress

WHILE the Priority Board is issuing embargoes on the movement of materials and products ordinarily regarded as necessities, the rivers of the United States continue to flow thriftlessly and aimlessly from the mountains to the sea. At the same time the railroads continue to burn coal in order to haul coal. Thirty-five per cent of the rail freight tonnage is coal.

These facts and many others are set forth in a recent article in the New York Tribune by Edward K. Hall, vice-president of the Electric Bond & Share Company. They are not newly discovered facts. War conditions and war necessities simply make them more pertinent. Congress has been told of them often enough. But, unfortunately for us now, Congress, in the enactment of constructive water-power legislation, has not kept abreast of the engineer in the improvement of generating and transmission equipment.

Our whole industrial structure seems to have been reared in the expectation that there would be a constant influx of cheap labor from immigration; that our mines were inexhaustible; that our transportation machinery would always be equal to the task of hauling endless streams of coal in every direction across the country. But every day the priceless, inexhaustible energy of gravity slips away.

It is gone forever, that which is already wasted; and so are past Congresses that have quibbled over the subject. But just as sure as there are countless millions of kilowatts of energy going to be handed to us on a platter in the future, just so sure is there going to arise a Congress of the United States that will handle this matter vigorously, the way it should be handled. The war has brought about great changes in the viewpoints of men. It is making big men. It will make big Congressmen.

The Business Situation

BUSINESS, as a whole, continues to be good. One very reassuring feature of the situation in the electrical industries from the manufacturers' standpoint is that stocks carried by jobbers, dealers and contractors are light. There has been a general disposition to avoid large stocks. This is partially due to high prices; and such prices, in view of the Government's price-fixing program, lead distributors to avoid loading up with merchandise until it can be definitely determined what the effect of the price-fixing propaganda will be on re-sale values. Heavy commitments in the near future are, however, inevitable.

Another encouraging factor is the apparently abundant supply of money to care for business. While the money market is close, with rates ranging from 5.5 to 6 per cent, under present conditions these are not a serious handicap to business. About the only place where there is a shortage of funds is in the security market and in speculative or hazardous enterprises. At the present time this country has little money for untried ventures. The demand on the capital market by the Government and by established industrial concerns, as well as the railroads, is too insistent to permit bankers to encourage speculation of any kind. The money actually used in business is being provided in such a way that commercial paper and other instruments of credit taken in return for banking funds can readily be discounted at the federal reserve banks. Hence business is being protected in the way it should be by our federal reserve banking system.

Necessarily the labor situation is a problem that the electrical field must also reckon with, especially while general trade is so good and government orders taking up more of the productive capacity than had been looked for a few months ago. There seems to be no limit to the demand for men. The selective draft has taken out of ordinary pursuits a very large number of men, and while women are being employed in almost every line of business and industrial activity, including electrical work, yet the introduction of women into these new lines of work has not sufficed; also manufacturers are finding it hard in many lines to produce more than there is an immediate demand for. One serious difficulty is in getting a supply of raw material, but the conditions that prevailed prior to the price-fixing program of the Government, when producers of finished apparatus were compelled to go into the open market and bid against competitors for materials used in manufacture, has been relieved by suitable regulations. Some lines of electrical business, of course, are handicapped by the priority given to those engaged in supplying the Government's needs, but this situation is bound to be materially relieved; and altogether the outlook is very encouraging.

Magnetic Circuit Simply Explained

A GOOD practical knowledge of the laws governing electrical and magnetic phenomena is needed by any man who is called upon to handle electrical equipment in a responsible manner. During normal times the need for this knowledge is supplied in varying degrees by technical colleges, evening schools, correspondence courses and other educational mediums. The abnormal conditions at present, however, which impose new duties on so many classes of employees in the electrical industry who are called upon to take up the work of men that have left to answer the nation's call, require an extension and intensification of educational effort in order that the work may go on efficiently.

Nearly all men engaged in electrical work have a more or less perfect general knowledge of the fundamental principles of the electric circuit, but a much more vague conception of the magnetic circuit. However, every practical electrical man should fully understand the workings of the magnetic circuit, because such a circuit forms an essential part of almost every important electrical device. As it is ordinarily discussed in textbooks, the theory of the magnetic circuit is rather involved and difficult to understand. In these textbook treatments the unsatisfactory concept of the unit pole is usually adopted and higher mathematics is used. It is, however, entirely practicable to impart a good working knowledge of the theory of the magnetic circuit without using either the unit-pole idea or higher mathematics.

In a series of five articles beginning in this issue, Terrell Croft gives a very good insight into the laws of the magnetic circuit. In his usually lucid manner he has presented a simple explanation of magnetic theories that usually are treated in an abstruse manner. It is for this reason that so few electrical men can make even simple magnetic calculations or design plain magnet coils intelligently. The necessary working knowledge may be obtained from a careful perusal of Mr. Croft's articles by any one who is already familiar with fundamental electrical principles, who can read English, and who knows arithmetic. On the basis of the explanations recited, magnetic circuits of the simpler forms may be designed accurately and intelligently. Although the treatment adopted by Mr. Croft is not entirely new, it is believed that this is the first time that these phenomena have been explained in such a simple, practical way and without the application of the calculus.

HAPPENINGS IN THE INDUSTRY

Restriction of Display Lighting—Law Will Protect Plants—Electrostatic Problems Discussed—Engineers Being Classified—Water Powers Developed in France

NEW YORK EDISON LITTLE AFFECTED BY RESTRICTING DISPLAY LIGHTING.

Reduction Three-Tenths of One Per Cent. of Total Business—Complication Over the Contracts.

The order of Fuel Administrator Garfield, limiting use of coal for electric display advertising to the hours between 7:45 and 11 p. m., will result in an annual saving of about 5,000 tons of coal in New York City. This estimate is based on the statement that the reduction in lighting would result in a saving of one-half the fuel used to generate the electricity now used in these signs and on a statement recently made by John W. Lieb, vice-president of the New York Edison Company, that about 10,000 tons of coal are used annually in New York City for the manufacture of electric energy used by this display lighting.

It has been estimated that approximately 250,000 tons of coal are used in a year to make the electricity used by display signs and "white way" lighting in the various cities throughout the country. Therefore, the order curtailing the use of electricity by signs and "white ways" is expected to result in a saving of 125,000 tons of coal annually throughout the country.

According to an official of the New York Edison Company the electricity used to illuminate signs in New York City is equivalent to six-tenths of one per cent of the company's production. As the present order curtails only one-half of the sales of electricity for this purpose the reduction amounts to but three-tenths of one per cent of the total business of the company.

A rather complicated situation is brought about in New York by the order. This is due to the fact that the Edison Company has long-term contracts for display lighting with its customers. The contracts do not control the time when the signs shall be illuminated or when they shall be extinguished, that being up to the discretion of the consumer. It will be necessary, therefore, for the Public Service Commission for the First District to issue an order permitting the company to limit the use of electricity for signs to meet the requirements of the Fuel Administrator's order, which went into effect at midnight of Thursday, November 15.

The various public utility companies throughout the country have co-operated with the Fuel Administrator in his efforts to conserve coal for war purposes. Recently the National Committee on Gas and Electric Service, of which Mr. Lieb is chairman, and which represents the electric light and power companies, gas companies, water works companies, and central steam heating companies throughout the country, adopted a resolution pledging its support and co-operation with the national authorities in the carrying out of any plan or regulation for the saving of fuel as a war measure.

NEW LAW WILL PROTECT UTILITY PLANTS.

Federal War Measure Provides Stringent Punishment for Carrying Explosives—Must Secure License.

Although there have as yet been practically no attempts by the enemy to strike at our military or industrial preparedness through the wrecking of electric central stations, the reason undoubtedly lies in the elaborate precautions which have been taken to guard against attack. Central-station operators will therefore be keenly interested in a new war measure passed by the latest Congress which is now being put into effect by the Bureau of Mines, Department of the Interior, which provides for a heavy fine or imprisonment or both for carrying explosives without a Government license.

The various provisions of the law, which are given herewith, constitute a warning which could well be given publicity by central-station companies in the form of posters placed about the premises of the plant. In some locations it would even be desirable to have the matter printed in foreign languages. The old adage that an ounce of prevention is worth a pound of cure singularly applies in this instance.

The new law provides that any person in the United States found with explosives in his possession after November 15, and who does not have a license issued by the Federal Government showing the purpose for which the explosives are to be used, will be at once arrested and fined up to $5,000 or sent to prison for one year. If the circumstances warrant, the person may be fined $5,000 and in addition given the one year in prison.

Francis S. Peabody, of Chicago, a well known coal operator familiar with the use of explosives, large amounts of which are used in the coal-mining industry, has been appointed by Secretary of the Interior Lane to act as assistant to the Director of the Bureau of Mines, Van H. Manning, in the enforcement of the law. Under the law, the director of the bureau is empowered to utilize the services of all United States officers and all police officers of the states, including the city police forces, county sheriffs, deputies, constables, and all officers in any way charged with police duties. The police of the cities have already been organized for this work, headed by a committee of chiefs of police in the big cities, of which Major R. W. Pullman, superintendent of police of Washington, D. C., is chairman. The police are not only to look after the enforcement of the law, but are also to make thorough investigations of all dynamite outrages and fires in factories and warehouses, and to make their reports to the Director of the Bureau of Mines.

Persons apprehended in plots to blow up factories and bridges will be turned over to the authorities for prosecution under Federal or state laws. Most states

have specially severe punishments for these crimes. New York has an extreme penalty of 25 years' imprisonment for the placing of dynamite with intent to blow up property. The penalty provided in this Federal war measure is merely to cover the illegal possession of explosives.

The law provides that everyone who handles explosives must have a license. The manufacturer, the importer and the exporter must have licenses issued by the Bureau of Mines in Washington. The seller of explosives and the purchaser of explosives must also have licenses, these to be issued generally by county clerks, or other local officers who are authorized to administer oaths. There will be at least one licensing officer in each county, and more agents will be designated if the county is sufficiently large to warrant it. If a state has laws providing for a system of licensing persons manufacturing, storing, selling or using explosives, the state officials authorized to issue such state licenses shall be designated as federal licensing agents; also city officials qualified to issue city explosive licenses will be given authority to issue federal licenses. A federal license will not relieve any person from securing licenses required under state laws and local ordinances.

In each state there will be appointed a state explosives inspector, who will represent the Bureau of Mines in the administration of the law within the state.

Only citizens of the United States or of countries friendly to the United States and the Allies may so obtain licenses.

Contractors, mining companies, quarrymen and others using large quantities of explosives, which are handled by employees, may issue explosives to their employees only through those employees holding a license, called a foreman's license.

The purchaser of dynamite, in obtaining a license, must state definitely what the explosive is to be used for and will be held accountable for its use as stated and the return of any explosives that may be left.

With the strict enforcement of this law, the federal authorities hope to prevent explosives falling into the hands of evilly-disposed persons and to put a stop to all further dynamite plots.

DOHERTY COMPANY BUYS MANSFIELD CAR LINE.

New Property Will be Consolidated With Mansfield Electric Light & Power Company After Approval of Ohio Utilities Board.

The Mansfield (O.) Electric Light & Power Company has contracted to purchase the property and franchises of the Mansfield Railway, Light & Power Company. The addition of Mansfield's traction lines to the list of Doherty properties has been under consideration for some time, and now the application to combine the two Mansfield properties goes before the Ohio Public Utilities Commission. There is every reason to believe, therefore, that in a short time all the electric producing plants in Mansfield will be controlled by the Doherty organization.

R. F. Carbutt, railway engineer of the Doherty organization, says that as soon as the traction property passes into Doherty control the line will be generally overhauled. At present the traction property is in a fairly good state of repair, says Mr. Carbutt, and no important changes in equipment will be needed for some time.

In addition to serving Mansfield, the new Doherty traction property includes an interurban road to Shelby, a nearby town. When united with the Mansfield Electric Light & Power Company, the new property will be operated with the old, under the managership of R. E. Burger, manager of the original Mansfield properties.

The power plant of the Mansfield Railway, Light & Power Company will not be used to furnish current for the operation of the new Doherty traction property, and power will be obtained from the recently completed Melco plant.

SOLUTION OF HIGH-VOLTAGE ELECTROSTATIC PROBLEMS.

Chester W. Rice Presents Classic Paper Before 334th Meeting of American Institute of Electrical Engineers.

The monthly meeting of the American Institute of Electrical Engineers, held in New York City on November 9, was made memorable by the presentation of a mathematical paper, which was declared by several speakers to be a classic in its line. The meeting was called to order by Vice-president B. A. Behrend, who turned it over to Prof. Frederick Bedell, chairman of the Electrophysics Committee. The paper of the evening was presented by Chester W. Rice, of the General Electric Company, and was entitled "An Experimental Method of Obtaining the Solution of Electrostatic Problems, With Notes on High-Voltage Bushing Design."

This paper was one of the longest ever presented before the Institute, comprising about 85 printed pages, with 62-page appendix devoted chiefly to the mathematical development of the formulas. The paper develops the electrodynamic method for obtaining the solution of electrostatic and similar problems. This method is developed to a very high degree of accuracy and is applied to the study of high-voltage bushings. An experimental high air-efficiency bushing was built and tested with the result that the arc-over voltage was much lower than had been anticipated. A study was made to ascertain the reason for this discrepancy, which was found to be due to an unexpectedly large surface effect that varied greatly with different materials. After obtaining the value for this effect, a reasonably accurate predetermination of the arc-over of structures, in which the stress distribution is known, can be made.

In order to determine the desirability of using artificial equipotential surfaces to increase the efficiency of the supporting dielectrics, tests were made and diagrams taken, after which a small bushing of this type was constructed and tested. A study was then made to find out whether the reduction in diameter of condenser bushings is due principally to equalization of potential or to the greater strength of insulation when barriers are used. This resulted in the conclusion that the barrier effect greatly predominates. The paper further discusses the difficulties of obtaining a sufficiently exact theory of bushing design to enable the predetermination of the most efficient shape for a practical bushing. A series of small bushings were made and tested, with the view of determining the general shape and characteristics which go to make up a practically all-round bushing.

The appendix gives an unexpurgated solution of the following two flow problems: 1. The distribution of the electrostatic field when any two confocal hyperboloids of revolution of one sheet and of the same

family are maintained at given potentials. 2. The distribution of the electrostatic field when any two confocal hyperboloids of revolution of two sheets and of the same family are maintained at given potentials.

The discussion of the paper was opened by Maj. R. D. Mershon, who referred to some tests he had made with built-up insulators, in which it was found that they stood the laboratory tests beautifully, but broke down when tested so that there was a strong power arc. C. O. Mailloux expressed his appreciation of the wonderful ingenuity shown by the author in applying Laplace's equation and developing from it a new system of co-ordinates. John B. Taylor expressed surprise at getting such beautiful curves when it would be expected that the exploring point would make a marked effect on the conditions. A. M. Gray described a photographic method that he thought might be used to give an actual picture of the conditions existing in a problem of this kind. C. Le G. Fortescue referred to some investigations along this line made by himself and Mr. Farnsworth, which had not been carried out as completely, however; unfortunately misleading assumptions were based thereon. E. D. Eby questioned one of Mr. Rice's statements that in an ideal bushing all of the dielectric is stressed uniformly with respect to its strength. He also called attention to the effect of the specific resistance of the testing water upon the wet arc-over voltage. F. W. Peek, Jr., illustrated the investigations of Mr. Rice in such a way as to give a physical picture of what they indicated. M. E. Tressler referred to some tests made in which different results were obtained when numerous layers of dry paper and varnished cloth were used in groups and then alternately. H. O. Stevens referred to the value of Mr. Rice's investigation for improving the design of satisfactory bushings. S. W. Farnsworth said that Mr. Rice's results were by far the most accurate he had ever had called to his attention. C. T. Orcutt referred to some investigations along this line he had conducted some time ago. B. A. Behrend referred to a hydrodynamic solution of three-dimensional problems. The discussion was closed by Mr. Rice.

ENGINEERING SOCIETIES CLASSIFYING THEIR MEMBERSHIPS.

American Institute of Electrical Engineers and the Illuminating Engineering Society Actively Classifying Members for Possible Government Service.

The national engineering societies decided a short time ago to make a new and complete classification of all their members, with special reference as to their experience and availability for the service of the Government for either military, naval or various civilian purposes. Both the American Institute of Electrical Engineers and the Illuminating Engineering Society are proceeding with the work, classification blanks having been sent to every member. The latter society has even extended this classification to non-members who are engaged in illuminating engineering or similar work, so that the census obtained will be even more comprehensive than if restricted to the actual membership of the society. It is believed that this classification and its index will prove of value not only for the immediate needs of the Government during the war, but even of greater value during the reconstruction period following the conclusion of the war. Throughout all this effort, which is involving considerable expense on the part of the engineering societies, the idea is to secure a complete census of engineers, so that the services of each individual may be utilized to the best advantage of the nation and also of the engineers themselves.

SAYS GOOD LIGHTING POINTS ROAD TO VICTORY.

New Business Bulletin Tells Doherty Men to Help Country by Improving Factory Illumination.

Using as its text President Wilson's recent utterance that "It is evident to every thinking man that our industries, on the farms, in the shipyards, in the factories, must be made more productive and more efficient than ever," the current issue of the New Business Bulletin tells members of the Doherty organization that one of the best services they can render at this time is to work for better factory illumination in order to make that efficiency possible.

Here are some extracts from the introduction to the Bulletin which sum up the attitude of the new business department in regard to its duty at this time:

A fine service to render your country is to labor unceasingly, selling better factory lighting.

Next to the vast resources of this country in men and materials, are the factories that count in the war, and in supplying them with better lighting you are making them more productive. You are thereby surely helping to win the war.

Makeshift lighting and obsolete equipment so seriously hamper factory production that the time lost may easily be from fifteen to thirty minutes of each worker's time per day.

The average cost for installation and operation of good lighting equipment, on the other hand, is a paying investment if it saves but four minutes a day for workers.

When "more production and greater output" is the cry everywhere, every operating plant in the country as well as those now being built or remodeled, must operate all night as well as all day. The one great and indispensable requirement for high-class and high-speed production is good lighting—not merely lighting but good lighting—and it's quite safe to say that the better the lighting the better the production as well as the quality, for there is little danger that overlighting will be attempted.

The opportunities to sell lamps and lighting have never before been so numerous, nor has the demand for better lighting ever been so insistent. Men in all walks of life have realized the advantages of good and sufficient lighting from economic as well as hygienic standpoints, and have not hesitated to say so. An analysis of industrial accidents in this country and abroad shows conclusively that, as the days grow shorter in the fall and winter, accidents multiply, indicating that inadequate lighting is responsible for the unnecessary sacrifice of life and limb and waste of material.

WATER POWERS BEING ACTIVELY DEVELOPED IN FRANCE.

Large-Scale Hydroelectric Developments in the Alps, Pyrenees, and in Central France.

In answer to a question on the subject in the French Chamber of Deputies, the Minister of Agriculture recently stated that, in accordance with a decree issued in December last year, all questions relating to

the utilization of the power of non-navigable rivers and streams in the country had for the period of the war been transferred from the Ministry of Agriculture to the Ministry of Munitions. At the same time, close co-operation continued to exist between the two departments, with the object of utilizing all available water power.

As affording some idea of the work that had been done, he stated that equipment to the extent of 400,000 horsepower had been installed, or was in course of construction, in the Alps, the Pyrenees, and in central France. He also pointed out that, in the case of many of the agreements entered into on behalf of the French Government with hydroelectric undertakings, powers had been reserved under which the generating stations were under agreement to supply for a number of years after the war a certain proportion of the current generated at a cheap rate. Several of the plants in question were in connection with factories making explosives with a calcium carbide base. With the cessation of hostilities, it would not be difficult to convert such plants to cyanamide manufacture, and consequently there were good prospects of large and relatively cheap supplies of synthetic nitrate manures, which would be of great benefit to French agriculture.

OPPORTUNITY FOR SKILLED WORKERS IN AIR SERVICE.

Aviation Section of Signal Corps Needs Many Mechanics and Electricians for Immediate Service.

There is room on the ground behind the lines abroad for capable skilled American workers. The air fighters need the backing of skilled men to keep each airplane ready for instant and constant service, to bring up supplies, ammunition, food, clothing, without all of which the men in the air are useless, and to construct and maintain the airdromes for housing the planes and quartering the men.

Squadrons have been and are now being formed for service abroad. Picked men are being enrolled from various classes of skilled workers; these men will be given special training, according to their vocations, in work required in the air service. They will get actual practice work on airplane motors, trucks, airdrome construction, and everything that will be done on the other side. Non-commissioned officers will be chosen from among them.

The Air Service calls for the following kinds of skilled workers (arranged in the order of number of men needed): Chauffeurs, auto mechanicians, automobile engine repair men, office clerks, carpenters, radio operators, electricians, instrument repair men, cooks, coppersmiths, armorers (machine-gun repair men), sail makers, photographers, machinists, blacksmiths, motorcycle repair men, stenographers, cabinet makers, draftsmen (mechanical), magneto repair men, metal workers, automobile engine testers, rope riggers (cordage workers), propeller makers, riggers (airplane assemblers), telephone linemen, tool makers, vulcanizers, welders, lithographers, packers, telephone operators, motorcyclists, plumbers, painters, tailors, gasworks employees, buglers, molders, pattern makers, telephone adjusters, barbers, truck masters, bricklayers, cobblers, propeller testers, boat makers and saddlers.

Applicants must be physically sound, white, and from 18 to 40 years of age. They should mail the application as directed below. If accepted, they will receive a card to take to the nearest recruiting station. This card will assure being enlisted, if physically fit, in the Aviation Section of the Signal Corps, and assigned to proper kind of work.

Recruits will be enlisted as privates and will remain as such until assigned to proper places in a squadron. After enlistment the men will be sent to a camp for several weeks of military training and special instruction in the work required.

Squadrons are being formed continuously and as soon as a man is qualified he is assigned to a squadron and given rank according to his ability. All skilled workmen in the special trades enumerated rank as sergeants or corporals. Clothing, food and quarters are provided free, and the pay is in addition; it should be remembered that this pay is clear gain, as living expenses are borne by the Government. The men will be right up behind the lines, as near the front as the airdromes can be taken safely and right in the midst of the greatest fight the world has ever seen.

To enlist, the applicant should write his application substantially in the following form and mail it promptly to the address given:

Volunteer Bureau, 119 D Street, N. E., Washington, D. C.

I desire to enlist, as a skilled workman, in the Aviation Section of the Signal Corps.

Name .....
Address .....
.....
At present employed with.....
.....
Trade ..... No. years in trade .....
If you will be called by draft, when?.....

ELECTRICAL EXPORTS FOR AUGUST SHOW FURTHER DECREASE.

Marked Reduction From Preceding Months and Practically no Gain Over a Year Ago.

The total value of electrical exports from the United States during last August shows a decrease of over $200,000 from the July figures and a very heavy falling off from the record total ($5,837,056) of last June. The total is practically the same as that of August a year ago, although the values for the various subclasses of course are different. The following table gives the detailed figures as disclosed in the August summary of foreign commerce issued by the Bureau of Foreign and Domestic Commerce. A comparison is also given with August, 1916.

Articles.	August, 1917.	August, 1916.
Batteries	$ 242,668	$ 161,513
Carbons*	137,055	.....
Dynamos or generators	155,029	216,626
Fans	42,736	34,333
Heating and cooking apparatus*	22,174	.....
Insulated wire and cables	389,909	406,526
Interior wiring supplies, including fixtures	111,961	80,707
Lamps—		
Arc	486	1,672
Carbon-filament	18,063	3,747
Metal-filament	178,457	100,571
Magnetos, spark plugs, etc.*	202,680	.....
Meters and measuring instruments	69,955	89,579
Motors	136,232	402,489
Rheostats and controllers*	18,762	.....
Switches and accessories*	123,546	.....
Telegraph apparatus, including wireless	47,735	25,488
Telephones	118,551	124,234
Transformers	95,311	107,619
All other	1,195,968	1,839,414
Total	$3,607,278	$3,601,518

*Included in "All other" prior to July 1, 1917.

A comparison of the eight-month periods ended August 31 for the last three years shows the following total value of electrical exports: 1917, $36,032,820; 1916, $23,536,406; 1915, $14,976,659.

NEWS NOTES

War Service Committees.—It has been decided that the war service committees of the Associated Manufacturers of Electrical Supplies, the Electric Power Club and the Electrical Manufacturers' Club, which will soon co-operate with the Government, shall consist of two members from each of the above organizations. As soon as the personnel is complete a meeting will be held to discuss ways and means for immediate action.

Electric Plant in New Brunswick Opened.—An electric light and power plant designed to serve the two New Brunswick municipalities of Rexton and Richibucto, in Canada, both in the Moncton consular district, was completed recently. The generating station is operated by water power developed from a dam across the Kouchibouguac River, 12 miles upstream from Richibucto. This dam is 210 feet long and stands 28 feet high on a base of 30 feet; the spillway is 21 feet.

Utility Company Starts a Weekly Paper.—Bay State Street Railway, Boston, Mass., has begun the publication of a weekly newspaper, devoted to the interests of its patrons, and seeking to establish a better understanding with the public. The company purposes distributing about 90,000 copies free each week, to passengers on its cars and in waiting rooms, and other copies are to be mailed to homes of citizens. The controlling idea is to find a get-together basis for workable relations.

Higher Wage Scale Granted at Portland.—An eight-hour day and the 38-40-45-cent wage scale asked by the platform men of the Portland Railway Light & Power Company, Portland, Ore., have been granted by the board of arbitration. The new wage scale became effective at once. Findings of the board will be in effect until January 1. It is hoped by that time the means will be found by which the revenues of the company can be sufficiently increased.

Report of Pasadena Municipal Lighting Plant.—The Municipal Lighting Works Department of Pasadena, Calif., has issued its annual report covering the fiscal year ended June 30, 1917. The total receipts were $248,614.17, a gain of 16 per cent over 1915-16. The output was 7,988,300 kilowatt-hours, a gain of 23.9 per cent over last year. The number of customers increased 8.93 per cent. The total cost of energy sold per kilowatt-hour decreased 9.45 per cent in spite of an increase of 54 per cent in the price of fuel oil. C. W. Koiner is general manager of this municipal department.

Boiler Manufacturers' War-Service Committee.—In compliance with resolution adopted at meeting of manufacturers with National Chamber of Commerce, requesting all branches of industry to appoint a war-service committee to act as "point of contact" between said industry and the Government during the war, the American Boiler Manufacturers' Association appointed the following committee: W. C. Connelly, president D. Connelly Boiler Company, Cleveland, O., chairman; G. S. Barnum, president Bigelow Company, New Haven, Conn., and George W. Bach, manager Union Iron Works, Erie, Pa. Communications should be addressed to the chairman.

Electrical Manufacturers Co-operating With Government.—The Associated Manufacturers of Electrical Supplies announce that the next meeting with the Government officials will be held on November 21 and that some very important steps along co-operative lines will be taken at that time. It will be remembered that at a previous meeting of this kind this association was able to secure immediate results in solving some of the cable problems, saving about 40 per cent in prices and getting deliveries on much of the cable needed within a few days to two weeks' time.

Need for Water-Power Development Forcefully Presented.—In a recent statement made by Edward K. Hall, vice-president of the Electric Bond & Share Company, the situation as to power needs and hydro-electric development is very clearly presented as follows: "It is difficult to conceive how new increments of power from coal can be provided without utterly breaking down our present facilities for distribution. The railroads of the country are in no position at this time to lay more track, build new terminals and increase their rolling-stock equipment. We can, and we must, substitute copper wires for steel rails, use water power instead of coal, and add substantial increments to our power supply, thereby relieving transportation facilities and assisting industries everywhere."

Prominent Engineers Guests of Honor at Chicago Banquet.—At a banquet held on November 9 in the City Club by the Chicago Chapter of the American Association of Engineers, a large number of prominent engineers were guests of honor and enjoyed Capt. Robert W. Hunt's talk on "Our War," in which he emphasized that this is an "engineers' war." Over 400 engineers were present and were inspired by the vivid description of conditions in the warring countries as given by a man who for 28 months was in the trenches of "no man's land." F. H. Newell, head of School of Civil Engineering, University of Illinois, discussed the activities of the American Association of Engineers on "What Are We Here for?" The organization's appreciation for service well rendered by Past-president Garrison Babcock, now captain in the Signal Corps, was expressed through the presentation of a saber by W. H. Finley.

University of Illinois Students on Inspection Trip.—The annual inspection trip of senior students of the College of Engineering of the University of Illinois was conducted November 8 to 10, inclusive. Groups of students in architecture, architectural engineering, civil engineering, electrical engineering, mechanical engineering, municipal and sanitary engineering, and railway engineering took part under the special direction of members of the respective faculties. The students in electrical engineering under the direction of Prof. Morgan Brooks, paid visits to the following plants on the three days mentioned: Northwest station of the Commonwealth Edison Company, Chicago; Westinghouse Lamp Company, Milwaukee; generating station of Milwaukee Electric Railway & Light Company; factory of Cutler-Hammer Manufacturing Company; receiving station of Wisconsin River Power Company; works of Allis-Chalmers Manufacturing Company, West Allis, Wis.; new steam-electric station of Public Service Company of Northern Illinois, south of Joliet; water-power station of Public Service Company in Joliet; Scott Street works of American Steel & Wire Company, Joliet; Joliet works of Illinois Steel Company. The electrical party included 36 students.

Notes on Commercial Practice

New-Business Methods, Policies, Rates and Kindred Central Station Matters for the Man Engaged in Selling Electricity

CENTRAL-STATION POWER IN BENTON HARBOR AND ST. JOSEPH, MICH.

Public Utility Service and Motor Uses In Factories—$50,000 Being Spent on Betterments.

By W. A. Scott.

Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., is a utility organization of considerable scope in the service it renders. It operates 18 miles of city traction lines in Benton Harbor and St. Joseph, which two cities are commercially one, being separated from each other by the St. Joseph River; the most of these city roads are double-tracked lines. It operates 40 miles of interurban lines—one from Benton Harbor to Dowagiac, and another line to Watervliet, each a single-track trolley road. Its rural light lines, of 75 miles, cover an extensive area in the vicinity of Benton Harbor and St. Joseph, one line extending 16 miles in a southerly direction. The lighting service supplies Benton Harbor, St. Joseph, Coloma, Watervliet, Mellburg, Eau Claire, Grand Center, Stevensville, Bridgeman, Baroda, Derby, Glen Lord and Scotdale.

The company is spending $50,000 on improvements, consisting of the rebuilding of its switchboards and its St. Joseph substation, putting in new cables and new instruments; and the changing of its transmission lines from 2300-volt delta-connected to 4000-volt Y-connected, which applies to all light and power lines. This company produces no power, but purchases current from the Indiana & Michigan Electric Company of South Bend. The power is received at 26,000 volts at the Benton Harbor company's St. Joseph substation transformers, where it is stepped down to 500 volts for the traction lines, and to 220 volts for motors in manufacturing plants. As a direct user for its own utilities, and as a distributor of power to factories in the two cities, the Benton Harbor-St. Joe Railway & Light Company buys and consumes an average of 30,000 kilowatt-hours of electricity per day. The company recently completed the laying of a 500-foot submarine cable across St. Joseph River, which, when in service, will replace the cable originally laid. The new cable, which connects a feeder line from the substation on the St. Joseph side with the Edgewater factory district on the Benton Harbor side, consists of a three-strand copper wire line, with a combination rubber and linen tape insulation, all within a lead sheath, wrapped with jute; finally, this is spirally wound with 14 No. 8 steel wires to hold the jute covering in place. The new cable will soon be in use. All current sold for light and power is metered, and the company now has 5600 meters on its lines.

A special drive for new business has been made this year, under the guidance of C. K. Minary, president, and J. F. Cavanaugh, superintendent. The service comprises power for factories, commercial and residential lighting in cities and towns, and rural lighting and power; many farms are equipped with motors for pumping water, for fruit-tree spraying, feedmills and other uses. Current for cooking ranges amounts to a considerable item, one department of the company's business being for the sale of electric ranges and electrical appliances.

Among the concerns here which have completed changes from steam to electric power are Mandel Manufacturing Company, which will use 40 motors of the combined capacity of 160 horsepower; and the St. Joseph Iron Works, which has installed 10 motors of 60 horsepower; and the Baker-Vawter Company, which has 100 motors of 300 horsepower. Since January 1, 1917, power contracts have been made with the Superior Steel Castings Company for 500 horsepower; the Benton Harbor Drop Forge Company, for 150 horsepower; the Auto Specialty Company, St. Joseph, for 200 horsepower, which has an enameling oven, served through three 50-kilovolt ampere transformers; and the new plant being built by the Benton Harbor Stove & Range Company.

Electrical equipment and the applications of electric energy, as observed in a number of manufacturing plants at Benton Harbor and St. Joseph, may be described as follows, all companies mentioned buying central-station current:

The Crary Machine Works, Benton Harbor, makers of locomotive parts and accessories on special orders, operate 30 shop machines, divided into groups, and driven by 5-horsepower motors by belt connections with line shafts. The machines consist of engine and turret lathes, milling machines, drill presses, grinders and gear cutters. The castings are produced at a foundry in the same factory district, the material used being malleable and gray iron and drop-forging product; and the parts are machined in the Crary shops, where the work involves a lot of detail. Other motors are to be installed in this shop.

Benton Harbor Malleable Foundry Company operates 21 motors of a combined capacity of 351½ horsepower. These include two motors each of 75 horsepower, one of 30 and two of 25 horsepower, the others running from 15 down to 3. The machines operated are two air compressors, each of 440 cubic feet free air per minute, for charging trucks and for charging three air-operated cranes; six sand blasts, a vibrator, a volume blower for the cupola furnace, and six exhaust fans are all motor operated, as are various machines in the pattern shop. In the air-furnace practice, the metal is melted with coal heat under forced draft from the Buffalo Forge Company's motor driven volume blower.

Superior Castings Company, Benton Harbor, has two single-phase transformers, at which current is received at 2200 volts, and stepped down to 220 volts for motor use. The transformer installation consists of two banks of three machines of 50 kilovolt ampere each. The motors in use have an aggregate of

352 horsepower, the power requirements of which amount to 110,000 kilowatt hours per month. A 100-horsepower motor is belt-connected to a 700-cubic-foot air compressor, used for sand blasts, enameling and annealing ovens and general shop purposes; a 62-horsepower motor drives an air compressor of smaller capacity, used for similar work; a 50-horsepower motor is direct-connected to a motor-generator set for supplying direct current to two overhead traveling cranes, of 20-tons and 10-tons capacity, respectively; each crane has a 66-foot span, with a 25-foot lift, and each has a 5-ton auxiliary hoist. A motor of 40-horsepower operates a sand mixer for moulding purposes; a line shaft for group drive is run by a 25-horsepower motor, the machines in the group being grinders, saws and shapers; two motors of 15-horsepower each drive two exhaust fans in connection with a sand blast; a 90-cubic-foot air compressor, used for atomizing oil for furnaces, is driven by a 10-horsepower motor; and a 300-ampere electric welder is served by a 20-horsepower motor-generator set; five smaller motors operate oil pumps and other equipment. All motors mentioned are alternating-current, 3-phase, 60-cycle machines. This is a new plant, having the capacity of 5000 tons of steel castings per year, and plans contemplate the doubling of that capacity, which, of course, means additional equipment and more electric power. The products are made of manganese steel, acid open-hearth steel, and low, medium and high carbon steel, also manganese-vanadium steel; such castings enter into the construction of mining, electrical, railway and general machinery and equipment. W. R. Gilmore is vice president and general manager.

Baker-Vawter Company, manufacturer of metal filing cabinets, Benton Harbor, has completed a change from its own steam-electric power, in which direct-current motors were employed, to central-station service, and to alternating-current motors. The steam plant is still utilized for heating the buildings and for the enameling ovens. The 100 motors, amounting to 300 horsepower, are all the General Electric, alternating-current type. There are four line shafts for arranging group drives, but such machines as punch presses, slotting machines and air compressors are driven by individual motors, 12 of these machines being connected to the motors by geared couplings, with rawhide pinions on steel gears. The largest motor, 50-horsepower, drives an air compressor that supplies air for spraying in the enameling plant and for other uses. Current is used at 220 volts, 60-cycle, 3-phase, the motor speed ranging from 900 to 1200 revolutions. The new transformers now in use consist of three banks; one bank of three transformers, 50-kva. each, for motor operation; a second bank of three 15-kilovolt ampere machines for lighting; the third, of three 15-kilovolt ampere each for spot welding. This is also General Electric equipment. The new switchboard, containing motor panels, light panels and spot-welder panels, was made by Mutual Electric Company, Detroit. There is also a special distributing and control panel installed in each of the following departments: Automatic screw machine department, plating and polishing room, rough assembling room, card-index department, blacksmith shop, and in the boiler room in which an air compressor and drinking water pump are situated. The five spot-welders, made by the Toledo Spot Welding Company, are used in welding the metal parts of which the cabinets are made. In the change from direct-current to alternating-current, 40 new motors were required. The new administration building is illuminated by fifty 400-watt nitrogen lamps, known as the Eye-Comfort, indirect lighting system; and each individual machine in the factory is served by a 60-watt lamp, besides the general lighting from 80 400-watt lamps. The force in the metal departments is made up of 150 men. Coral A. Tyler, E. E., chief electrician, has had direct supervision of the changes and new electrical installations referred to.

The Famous Truck Company has opened a shop in St. Joseph in which motor trucks are being built. The bodies and some other parts are built, and the malleable castings required are produced elsewhere and assembled here. Five motors have been installed for driving planers, sanders, a shaper and jointer. An air compressor has been ordered for shop use; also a motor-generator set is being put in position for battery charging. F. N. Wilkenson and W. C. Henry are president and superintendent, respectively.

St. Joseph Iron Works formerly operated by steam power, but now have in use ten motors for individual and group drives. The cupola fans, grinders and elevator are each driven by belt-connection to an individual motor; the lathes and pattern shop machines are operated in group drives. The ten motors have a capacity of 50 horsepower.

Palmer Tire & Rubber Company has 20 motors and uses about 7000 kilowatt-hours per month.

Doherty New-Business Sales 50 Per Cent Above Last Year.

Sales by the new-business departments at the Doherty properties are one-half again as much as in 1916, according to a statement recently made by George Williams, manager of the new business department of the organization. Mr. Williams said that the growth this year was typified by the September figures which showed appliance sales amounting to $151,000 for the month, as compared with $59,000 for September, 1916.

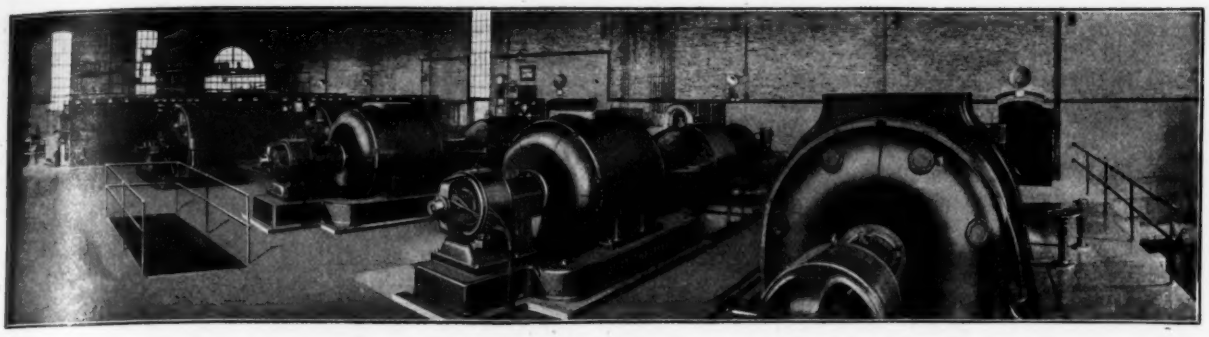
In commenting upon the increased sales, Mr. Williams pointed out that the war was chiefly responsible for the greatly increased demand for electric and gas appliances. He said that the war in causing a scarcity of labor in all branches of work, had not overlooked domestic workers, with the result that servant girls were scarce. This scarcity of servants has made the housewives of the country do their own work, and they have tried to simplify that work as much as possible. For that reason the labor-saving gas and electric appliances have been in great demand with the consequent benefit to new-business sales.

Electric Furnace Contracts for Public Service Company.

The Public Service Company of Northern Illinois has entered into a contract with the Ingalls-Shepard Forging Company, of Harvey, Ill., calling for the supply of 900 kilowatts for the operation of an electric furnace. This is the second electric furnace to be connected to the company's lines in that territory.

The furnace at the Ingalls-Shepard plant is of the Bailey type and replaces an oil-burning furnace which was objectional because of a scum from the fuel which was continually being deposited on the material treated.

Energy for this installation will be taken from a 12,000-volt line and a substation will be built on the customer's premises.



Notes on Operating Practice

A Department Devoted to Practical Problems of Plant and Operating Practice With Particular Reference to Electrical Generation and Distribution

VULNERABLE PORTIONS IN THE DISTRIBUTING NETWORK.

Preventive Measures That Can Be Adopted to Eliminate Ice Troubles in Distributing Systems.

By M. S. Montgomery.

The season is almost here when troubles due to ice and sleet and snow make themselves objectionable. It will not be long now before ill-carried out construction of the summer will tell its tale. Precautions that obviously ought to have been taken, but were not, will come to light. Improvements in apparatus and construction methods will make themselves realized and their importance appreciated.

There are certain troubles that might be considered as almost fundamental with distributing systems comprising a mixed system of underground and overhead conductors, in that they occur more or less until precautions followed from practical experience are taken to prevent them. Sometimes it is a matter of changing construction, sometimes merely the more judicious choice of apparatus entirely or in part. The forms of trouble in which interest now centers is that due to freezing and ice jams, for they will soon be in season.

Potheads and Cable End-Bells.

Potheads and cable end-bells are usually installed on a cable where the underground section connects to the overhead section at the pole where the underground cable goes up aerial. This is one vulnerable place in the system where trouble may be expected with the coming of snow and ice. If the pothead or end-bell is of a type or is so mounted that rain and snow instead of draining off are impounded they may creep into the interestices and crevices of the porcelain and between cable sheath and holder or bell. When the temperature drops the moisture thus in captivity freezes and may stress the porcelain or adjacent parts till they crack. Such troubles often do not show up by causing operating troubles until the temperature again rises, when the melting ice and snow or rains entering seep in through or are syphoned up by the paper insulation of the cable, causing breakdown of the insulation and necessitating pulling a new length of cable between manhole and pothead. Any piece of outdoor apparatus should be installed and designed so as not to allow hail or snow to become impounded, but to permit it to leak away gradually or, better still, rapidly or to be evaporated by sunshine and wind, thus reducing the chance of cracking due to freezing.

There is another cause of trouble very similar to the above and occuring in almost the same place, but it shows up in the fall after the dry summer months. It is due to corrosion and possible electrolytic action instead of to expansion. Where an underground cable comes up out of the ground—aerial it is called—it is usually protected in iron pipe which is known as a lateral. At the end of the lateral where the cable emerges is installed a cable end-bell. This end-bell acts to hold the cable in place by being clamped to the lead sheath in some way. But it also serves to seal up the end of the cable, the paper insulation of which is extremely hygroscopic. There are many forms of end-bells, made of iron, cement and various compounds, some made privately and others sold in the open market. These end-bells when placed are sealed up with some sort of sealing compound. In one case after an extended dry summer a number of cable failures occurred at the end-bells, following closely rain storms. At first it was thought the trouble was due to poor workmanship, but this was discountenanced as the trouble occured over widely scattered distances on bells installed by different men. Another hypothesis was advanced, namely that the cable failures were due to water that was harbored and had gotten into the cable insulation. Closer examination showed, perhaps not conclusively but with reasonable certainty, that what had happened was that water was impounded, and the acid content of the air due to the burning of large quantities of soft coal had caused sulphuric acid to form which had finally so corroded the cable as to allow moisture to enter it, causing breakdown. In another instance where a cement cable end-bell was employed trouble occurred, and was undoubtedly due to chemical action between the cement used and the lead sheath, possibly augmented and accelerated by contaminated air.

The importance of maintaining like metals in contact with one another cannot be too strongly borne in mind, because of possible galvanic action. Where

leakage of direct current is possible and where moisture will occur special effort ought to be made to prevent electrolytic action and corrosion hastened by chemicals brought down with the rain.

LATERALS AND DUCTS AND ICE JAMS.

Another cause of trouble, and usually an expensive one, is due to cables becoming frozen in laterals and ducts. A little ice does no harm, and the cable loosens up if the cable carries load. On the other hand if there is a large amount of ice and the cable becomes jammed in the duct or lateral, there is always the possibility of the lead sheath being compressed out of shape, injuring the insulation and perhaps allowing moisture to enter through the damaged sheath. Here again the failure of the insulation may not occur until the ice melts, some days or weeks after the thing actually happened.

The best way to prevent ice jams, in fact the only way, is to install ducts and laterals so that water will run off by natural drainage. Cement and vitrified clay ducts usually give little trouble from frozen water. It is the iron conduit of short length and the lateral that are the chief cause of trouble. One of the commonest causes is where a manhole or service box is closer to the surface than usual, and where the bottom of the lateral is below the level of the duct line running from manhole to elbow of the lateral. In this case water drains from the duct line into the elbow of the lateral, while water that enters the lateral from the pole also drains down to the bottom. Here there is no escape back to the manhole or into the soil, and should this water freeze trouble may be expected. Attention to drainage will save many a cable failure, around laterals especially.

Modern Boiler Control Methods for New Toledo Power Plant.

To the casual observer, the work of a fireman in the new East Toledo plant will resemble more nearly that of a switchboard operator than the usual grimy man with a shovel, because nearly all of the operations connected with firing will be performed from a control panel located at the side of each boiler. On this control panel will be all the instruments required or desirable in modern boiler plant practice.

By way of explanation, the boiler plant for the original installation will consist of four 1375-horsepower Bigelow-Hornsby boilers, and four 1456-horsepower Babcock & Wilcox cross-drum boilers. The boilers will be equipped with Taylor underfeed stokers of the power dump type. Additional equipment will include Sturtevant semi-steel economizers, and each boiler and stoker will be provided with individual motor-driven forced and induced draft fans and stoker drive.

Without leaving the control panel, the fireman can observe the steam pressure on a large illuminated suppressed scale steam gauge; the boiler output on a recording steam flow meter; the condition of combustion by means of a CO_2 recorder; the rate at which the stoker is pushing coal into the furnace as shown by a recording speed indicator on the stoker shaft; all of the draft readings essential to operation on a forced and induced draft installation, and a series of recording flue gas, feed water and superheated steam thermometers which he may refer to at his leisure. Should the boiler "throw over a little water" the recording superheat thermometer will record that fact. Push button and rheostat controls are located on the panel for controlling the speed of the forced and induced draft fans and stoker drive motor so that the fireman may regulate the coal feed, air supply, and boiler output with ease, and at the same time note on the instruments the effect of any change in conditions. The charts taken from the recording instruments will constitute a comprehensive log of boiler operation and will give food for study on the part of the efficiency engineers.

To further assist the firemen and improve boiler performance, each boiler will be equipped with two Copes feed water regulators. The draft in the furnaces will be maintained constant by means of balanced-draft regulators made by the Engineer Company. Diamond soot blowers will be provided on each boiler for keeping the tubes free of soot.

High Load-Factor at Alliance.

The electric plant at Alliance, O., due to a shortage in boiler capacity, is running on what might be called a suppressed peak schedule, which has had the effect of greatly increasing the load-factor. On Wednesday, October 31, with a peak of 2000 kilowatts, the 24-hour output was 41,650 kilowatt-hours, which is a load-factor of 87 per cent.

Owing to the Government having commandeered the boiler-tube supply, Alliance has suffered a serious delay in getting the new 500-horsepower Stirling boiler in service. This difficulty has been overcome, however, and it is expected that the boiler will be in operation about December 1. Meanwhile the load is being limited to what can be pulled on the present boiler capacity, or in other words, the capacity of the 2000-kilowatt turbogenerator unit.

Joplin Softener Reduces Boiler Scale to Minimum.

The water softener at the Empire District Electric Company's plant at Joplin, Mo., was put into operation in August, and according to advices received from D. G. Waggoner, results engineer for the western district, the scale in the tubes has been materially reduced and the system is generally satisfactory.

The plant is of the Scaife intermittent type and has a capacity of 60,000 gallons an hour. The plant is so laid out that it can be enlarged very readily, and plans are already on foot to increase it to 90,000 gallons capacity.

Iron Wire Used for 33,000-Volt Transmission Line.

The Public Service Company of Northern Illinois is building a 33,000-volt transmission line from its plant at Kankakee, Ill., to the yards of the Lehigh Stone Company, a distance of 7.5 miles. A load of 700 horsepower will be served. An interesting feature of the construction is that poles will be set 140 feet apart, an increase of about 40 per cent over usual spacings.

Traction Company Is Building Coal Pulverizing Plant.—Stone & Webster, through their Seattle office, have completed plans for a coal-pulverizing plant for the Puget Sound Traction, Light & Power Company to be built in that city. The structure required will be of reinforced concrete and mill construction, upon pile footings. It will be 26 by 88 feet, and 60 feet high, and is estimated to cost $80,000. These improvements are being made in conjunction with a change in power-plant equipment so as to use fine coal for fuel in place of oil.

Electrical Construction Notes

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Mounting and Wiring of Switchboards.

By S. H. Yorks.

In designing switchboards for power or lighting stations, the selection of the proper type of frame for supporting the panels is of considerable importance. The size and type of switchboard naturally fix the form of frame that is most suitable.

Switchboard frames built by the large manufacturing companies are of two general classes; those made from structural steel angles and those made from iron pipe.

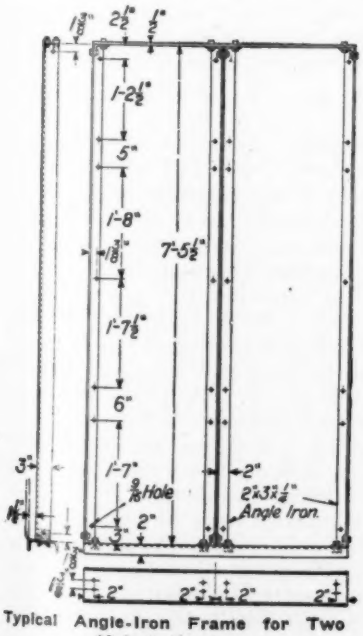
Angle-iron frames consist of angle-iron uprights supported on a channel-iron base or wood sill and provided with flat top irons, or ties, and the necessary corner angles. The top iron forms a continuous tie across the switchboard, provides a good alinement for the various panels, and also renders the bracing of each panel to the wall unnecessary. Wall braces are usually made of ¾-inch gas pipe with the necessary end connections for fastening to the frame and to the wall. The panels are bolted directly to the angle irons. This type of frame is best suited for heavy panels and large switchboards.

A typical standard angle-iron frame built for 90-inch panels by the Westinghouse Electric & Manufacturing Company is shown in the accompanying illustration. This frame includes a channel-iron base, to which the uprights are secured by means of the corner angles and bolts.

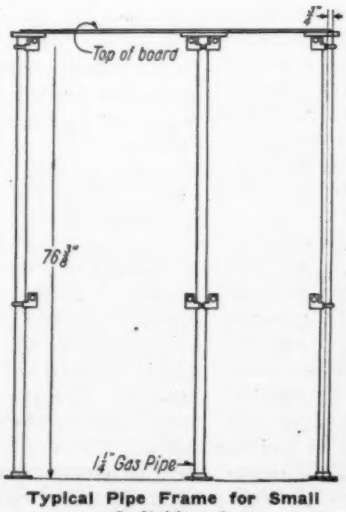
The chief advantage of this type of frame over any other is that each switchboard panel and its two angle uprights form a unit and may be handled as such in shipping and erecting. The panel may be completely wired by the manufacturer before shipment and the whole shipped to the customer ready for installation. Also any individual panel with its uprights may be removed from a switchboard for relocating without disturbing the connections on the panel. With this type of frame, wiring may be run along the angle uprights instead of directly on the rear of the panel, where such an arrangement is desired.

A standard Westinghouse pipe frame is also shown in one sketch. Pipe frames usually consist of ¾-inch or 1¼-inch wrought-iron pipe uprights resting in floor flanges and provided with top iron and the necessary top-iron brackets and panel-mounting brackets.

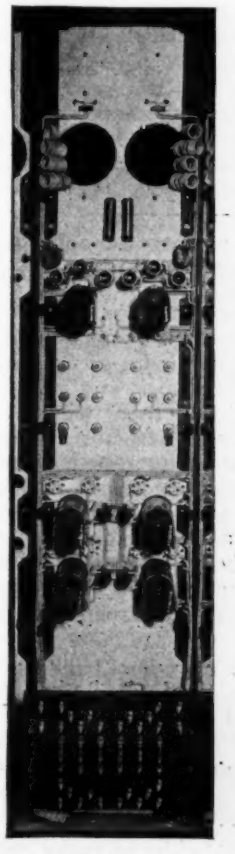
The application of this type of frame is limited to light panels and small switchboards. They are especially suitable for supporting panels that do not reach to the floor, as, for instance, a 48-inch panel on a 76-inch frame, inasmuch as the pipe uprights make a neat appearance without any covering.



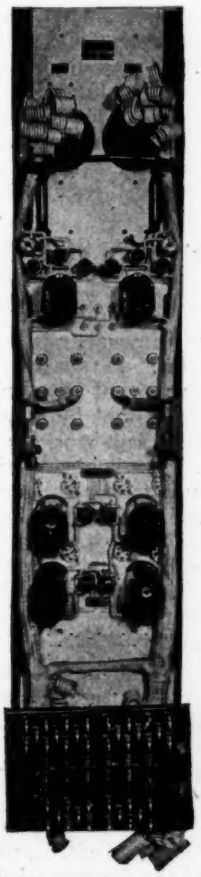
Typical Angle-Iron Frame for Two 90-Inch Panels.



Typical Pipe Frame for Small Switchboard.



Running Wires for Rear of Board Along Web of Vertical Angle-Iron Supports.



Other Method of Running Wires on the Rear of a Switchboard Panel.

When a switchboard consisting of two or more panels is mounted on pipe frames, one upright is common to two adjacent panels, and to pack each panel as a unit for shipment, a temporary upright must be supplied with each panel but one. On account of this additional expense, pipe-frame switchboards are usually shipped unassembled.

As compared with angle-iron frames, pipe frames are more expensive (when shipping and erection expenses are taken into account) and less convenient, except in the case of small single-panel boards.

Where a large amount of instrument and control wiring must be located on the rear of a switchboard, the arrangement of the wires becomes of considerable importance. This problem is taken care of in a very neat and satisfactory manner on switchboards mounted on the standard Westinghouse angle-iron frames, by running the wires up the webs of the vertical supports.

A comparison between this systematic arrangement of small wiring and the older arrangement, which consisted of running the wires up the back of the panel, is shown in the accompanying illustrations. The comparison tells its own story, and yet it should be remembered that the layout shown in the last illustration was a very creditable job at the time the board was made up, a couple of years ago.

With the new arrangement by placing the wires with due regard to the apparatus to which they connect on the panel, it is possible to bring them out opposite the particular piece of apparatus and run them horizontally to it along the back of the panel itself. This means that all wires are accessible and that what would ordinarily mean a rear extremely crowded with instrument and control wiring or with a bulky group along each angle, becomes a panel with wiring scarcely crowded at all.

This workmanlike and accessible wiring, however, is only possible where an angle-iron frame, such as the standard Westinghouse frame, is employed for supporting the switchboard.

Extensive Building of New Schools and Additions Authorized in San Francisco.

The voters of San Francisco, Cal., at the election on November 6, by a vote of about five to one, approved a proposed bond issue of $3,500,000 for the erection of new public schools and additions to existing school buildings. As there will be considerable electrical work in these structures, electrical contractors will doubtless be interested. There are to be built ten new elementary and three new high schools, also additions to ten schools. The elementary schools are to be two-story and the high schools three-story buildings, the latter being exceptionally well equipped with assembly and lecture halls, laboratories, gymnasiums, etc. The estimated expenditures are as follows:

Total for new elementary school buildings	$ 928,500
Total for additions to existing buildings	540,000
Total for high school buildings	1,200,000
Total for lands to be acquired	542,550
Total for equipment and emergencies	288,950
Grand total	$3,500,000

Plans will be prepared by or under the supervision of the Bureau of Architecture of the Board of Public Works, San Francisco, and every effort will be made to secure as speedy action as possible because the new school buildings are greatly needed.

Among the Contractors.

F. M. Barker, 1825 Euclid Avenue, Cleveland, O., has the contract for electrical installation in a large apartment building being erected by the Everett Company at Cleveland, O. The building will cost $50,000.

The electrical work in a theater and store building being built for C. A. Bressler in Cleveland, O., has been awarded to the Vedders Electric Company, Pythian Temple, Cleveland, O. Building will cost $10,000.

S. Kreitner, an electrical contractor of Benton Harbor, Mich., has organized The Electric Service Company to do rewinding of motors and generators and general repair work; battery charging will also be taken care of.

Contract has been awarded to the Ajax Electric Company, 203 St. Clair Avenue, Cleveland, O., for the electrical work in the new edifice of the Second Church of Christ Scientist being erected at Euclid Avenue and East Seventy-seventh Street.

All the electrical work in a large reinforced-concrete building being built at Baltimore, Md., for the Standard Oil Company, is being done by the Blumenthal-Kahn Electric Company, of that city. This is a conduit installation amounting to about $4000.

The Wentworth-Dean Electric Company, of Lima, Ohio, has been awarded the contract for electrical work in a large store building at Lima. G. E. Blum is the owner. Nearly 350 outlets will be provided for. The work is all in conduit and amounts to about $3300.

The San Francisco branch of the F. E. Newberry Electric Company has secured the contract for electrical work in a new eight-story reinforced-concrete office building being erected for the Exchange Realty Company in San Francisco. The contract price is $8074.

Russell & Company, electrical contractors, 56 West Forty-fifth Street, New York City, have been awarded the contract for the electrical work in the new building for George D. Smith, dealer in rare books. Mr. Smith will occupy the cellar, basement and first floor, the three upper floors to be used as apartments, two to a floor. The work is being installed with rigid conduits for the feeders and BX cable for the branch circuits. There is also a system of call bells throughout.

R. J. Nickles, who operates the Nickles Electric Shop at 120 South Hamilton Street, Madison, Wis., has recently been awarded the following important contracts: Complete electrical equipment for the Northwestern Ordnance Company, now engaged on important work for the United States Government; included in this installation is a total of 20 kilowatts in lighting units, using Ivanhoe-Regent reflectors; 2000 horsepower in motors of variable-speed type and complete wiring for same; a seven-kilowatt 5000-volt motor-generator; large electric furnace for gun shrinking; three other small buildings are also to be wired in connection with this plant. All the work is in conduit and the contract amounts to $20,000. Mr. Nickles is also installing a complete conduit system in the new Y. M. C. A. building at a contract price of $5000. Also an all-conduit installation in the new Beecroft Theater at a contract price of $3000. He is just finishing electrical work in the Physics Building for the University of Wisconsin, consisting of a great deal of electrical equipment for laboratory work of a special nature; most of this installation is conduit and the total contract price is $15,800.

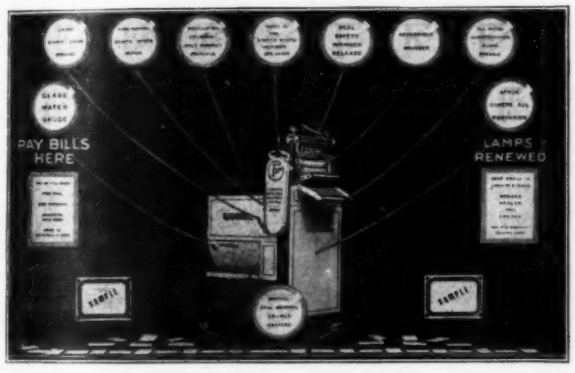
The Dealer and Storekeeper

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Appliances

Effective Window Display for Washing-Machine Campaign.

The window display shown in the accompanying illustration is now being used by nearly 1500 dealers handling Federal washers. The cut shows it in the Commonwealth Edison Company's Broadway branch electric shop in Chicago. This company conducted a campaign using newspaper advertising and also the window display in its different branches, resulting in one of the biggest washing-machine sales ever experienced from a similar campaign.

The posters are white with an orange border and the Federal "F" trade-mark on the background. The ribbons from the posters to the machine are orange and harmonize with the blue and white enamel finish



Window Display That Is Resulting in Large Number of Washer Sales.

of the washer. This display is probably the most effective ever put out by the Federal Sign System (Electric) for the benefit of its retail distributors.

METHODS FOR PARTICIPATING IN CHRISTMAS GIFT CAMPAIGN.

Society for Electrical Development Issues Book of Suggestions and Sales Helps.

Everyone knows to what extent labor, time and money-saving electrical appliances have been introduced into the home, and how energetically and successfully central stations, electric shops, contractors and others have been promoting the use of such devices. But it has been only with the sudden descent of war upon this country that there has been a real understanding of the genuine utility of domestic electrical appliances.

It is therefore fitting that this year all interests in the electrical industry should co-operate to foster the wide use of things electrical.

Apropos of this question of selling electrical appliances, this year's campaign of The Society for Electrical Development—"America's Electrical Christmas"—comes along at a most opportune time. Never before in the history of the industry was there a time when electrical merchandise played the part it will this year. Nor was the time ever more propitious for the electrical dealer than this season. The sale of electric appliances is not only the best thing the merchant can do for more business—and more profits—it is practically the only thing.

These facts, and others, have all received the most careful attention in a book just published by the Society, which is being sent gratis to members and non-members alike, upon request. It is designed for central stations and dealers who have arrived, those who are already there, those who are going, and the just started. It is a big book, 48 pages and covers, printed in many colors, profusely illustrated throughout, and filled with practical, timely suggestions, built for stores of all sizes in cities of all sizes.

The book has some 20 chapters, treating on everything from the store and window display, to the use of two very excellent movie films which the Society has prepared, in co-operation with the Universal Film Manufacturing Company. All the helps, copy, cuts, etc., are furnished practically free to members and non-members along the same broad liberal policy heretofore manifest in such previous campaigns as America's Electrical Week, Electrical Prosperity Week, Wire-Your-Home-Time, etc.

ESTABLISHMENT OF AN ENTERPRISING ELECTRICAL DEALER.

Well Equipped Quarters of the Canton Engineering & Electric Company.

The establishment of the Canton Engineering & Electric Company at Cleveland Avenue and Fifth Street, N. W., Canton, Ohio, is one of the best arranged for a city of its size that it has been the pleasure of the writer to visit. This company is the largest retailer of electrical merchandise in that city. Recently it retired from the contracting business so as to devote all of its attention to jobbing and retail merchandising.

The company occupies a well-built three-story brick building, which is arranged so that a fourth story may be added in the future. The prospects are that this will be done at no distant date. The first floor is occupied almost entirely by the principal display room and retail store, which is shown in one of the accompanying illustrations. The second floor is devoted entirely to the fixture display rooms. The third floor is being prepared for the offices of the company and for additional stockrooms.

In the view of the interior of the first-floor store it will be noticed that near the middle there is a square room effect. This constitutes the corner in the display

Establishment of the Canton Engineering & Electric Company.

Interior of Main Display and Retail Store on the First Floor.

window, which extends well into the store with fairly permanent walls. This room is trimmed differently each ten days, once being arranged as a dining-room and then after ten days changed so as to show an electric laundry, later a kitchen, sewing-room, etc. The electric stoves, which are shown in the illustration, are proving to be very popular in Canton and vicinity, owing to the rapid increase of new buildings and to the fact that the gas companies are unable to supply the demand because of the present shortage of gas. The store is used practically for display purposes only, since behind it is a separate stockroom, from which is made the distribution of every electrical article sold, this including even the smallest articles.

The third illustration shows the front room of the second floor. This room is used for the display of the higher-priced types of fixtures. A false paneled ceiling has been provided, which is 9 feet 6 inches from the floor. The ceiling fixtures are arranged to hang from the corners of the panels. Each fixture shown on the ceiling, as well as brackets, table and floor lamps, can be lighted. The arrangement for lighting the ceiling fixtures is unique. Groups of switches on the wall are arranged to light three fixtures at one time and these fixtures are in different portions of the ceiling. Every fixture is hung as it would be in the home. Thus the effect is very pleasing and the prospective purchaser finds it very much easier to make a selection than if the fixtures were hung much closer together. The windows in this room can be darkened by day, so as to produce the proper effect when the fixtures are lighted. In the evening an artistic portable lamp is set in each window and kept lighted, thus producing a very attractive effect from the street.

All the fixture rooms are provided with well finished hardwood floors, covered with attractive rugs. The wall decorations in each room are dark brown on semi-rough plaster, with cream-tinted ceiling. In the front room there is a continuous window seat on the two sides provided with windows; this really is a cupboard for keeping various types of glassware convenient for changing the details of the equipment on any fixture that happens to please a prospect. The table lamps are grouped on two large tables and arranged so that any of them can be lighted. Additional stands are placed below the table, so that the parts of any portable can be readily changed. In this room, as well as in the adjoining one shown in the last illustration, there are a number of bookcases, china closets and other good furniture, so as to produce as homelike an effect as possible.

The last illustration shows the middle large room on this floor and a part of the third room. In this middle room are shown fixtures somewhat less expensive than those in the front room, and in the third room are shown the more stock designs. Commercial units are all displayed in the rear room.

Front Room of Fixture Department on the Second Floor, Where the Highest Grades of Fixtures Are Displayed.

Middle Room of Fixture Department, Second Floor, and Portion of Third Room, Showing Less Expensive Fixtures.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 407.—MAGNETIC BRAKE.—The coils on a magnetic brake for an Otis elevator give trouble by burning out frequently. Each segment has 143 turns of No. 11 wire and two segments are connected in series across 240 volts. I would like suggestions for rewinding the coils to eliminate the trouble without changing the magnetic pull.—S. A. B., Reno, Nev.

No. 408.—FISHING WIRE IN CONDUIT.—In fishing wire in conduit what material may be used for "lubricating" the wire without injuring its insulation? What approved methods are used to aid fishing wire in long conduit runs or in runs with several bends?—A. S. N., Plymouth, Mass.

No. 409.—HEAT CONSERVATION IN POWER PLANTS.—In large power plants I understand every effort is made to conserve all the heat units, as for instance by using the air that has ventilated the generators for draft for the boilers, passing the condensate through a preheater at the top of the condenser, etc. To what extent is it practicable to do this in a small power plant, say one of 1000 to 2000 kilowatts capacity?—R. H. T., Lima, Ohio.

Answers.

No. 403.—SIGNAL CIRCUITS RUN OVER ROOF TOPS OF BUILDINGS.—In quite a few large cities it has been a custom to run telephone and telegraph wires and cables from one building to another over roof tops and across streets and alleys more or less indiscriminately. Are such circuits run with consent of the insurance interests? Is it necessary to secure special city permits or are the cables installed without securing any permit whatsoever? Have such cables been found a hindrance by firemen? Is there anything in the National Electrical Code covering them? In what cities, if any, are they positively prohibited?—C. E. M., Springfield, Ill.

I can only speak for Chicago's rules concerning the indiscriminate stringing of signal wires and cables over buildings, etc. A permit is necessary to install any wires, poles, etc., on or over public property for any purpose whatever. This, therefore, includes signal wires. The chief danger from careless installations of this class of wiring lies in the possibility of their coming in contact with primaries of electric-light installations, high-tension current thereby being led into buildings, etc. We try to keep such wiring from passing over roofs, but where it cannot be avoided the wires must be supported at least seven feet from roofs. I should say it certainly is a hindrance to firemen to find their progress blocked by a maze of wires on top of a building while performing their duties, such wires being liable to become highly charged at any time. The insurance interests generally pay no attention to signal work, leaving it entirely in the hands of municipalities. I would advise C. E. M. to send ten cents and postage, which I believe would not be over three cents, to the city collector's office, City Hall, Chicago, Ill., and procure a copy of our Chicago Electrical Code; he can then learn for himself how at least one big city is regulating signal wiring to prevent danger to life or property from accidental causes.—A. P., Chicago, Ill.

No. 404.—PROTECTING RAILWAY STORAGE BATTERIES.—In installing a large railway battery, what are the special precautions to be taken to prevent explosions? Also, how can the corrosive fumes from the battery room be prevented from attacking neighboring objects?—C. D., Milwaukee, Wis.

Answer A.—To prevent explosions around storage-battery rooms when installing, do all of the job requiring a flame before the cells are filled with electrolyte. After filling, and especially while charging, keep all flames away from the room. All buses and leads from the batteries should be lead-covered and painted with two or three coats of good asphaltum paint. Switch blades and all other parts that cannot be coated should be given a coat of petrolatum (vaseline).—H. E. W., Chicago, Ill.

Answer B.—The danger of explosion in a storage-battery room, regardless of whether it is for a railway battery, submarine battery, or other service, comes from lack of ventilation, which permits an accumulation of the gases given off during charge. A certain definite mixture of these gases is highly explosive. In the case of a closed battery compartment, if the hydrogen and oxygen are evolved at the rate of two volumes of the former to one of the latter without having a chance to diffuse with the air, a violent explosion will be produced by bringing a lighted match, flame or even a spark to the mixture. Even with air a certain explosive mixture may be produced that will depend on the relative amounts of free hydrogen and oxygen present. The first precaution, therefore, is to keep away from proximity of the battery during, and for some time after, charge any flame, spark or other means of possibly igniting any gaseous mixture that may be present. If any repairs have to be made involving use of a torch or lead-burning outfit, the battery room or compartment must first be thoroughly ventilated or blown out. As a second precaution the room should always be well ventilated, and especially during and after charge. This may be done by having liberal sized skylight ventilators overhead, if possible, or numerous windows on opposite sides of the battery room, so as to get a good natural draft to carry off the gases. If natural ventilation cannot be obtained effectively, due to poor location of the battery room (which is inexcusable, however, because this is one of the chief considerations in locating such a room), it is necessary to resort to mechanical ventilation. In this case exhaust fans should be located so as to pull out the air and gas mixture from all parts of the room, the inlets for fresh air being so located as to insure this.

If the storage battery be of the older and more common lead-sulphuric acid type, corrosion is caused from the fine film of sulphuric acid electrolyte that is carried off by the gas bubbles during charge and which settle on all surfaces in the battery room, more or less, unless there is a very strong ventilating draft to carry them out of the room. This action is especially noticeable toward the end of the charge, when the evolution of gas is strongest unless the charging current has been cut down to a very low value. The greater the violence with which the bubbles of gas are driven off, the more of the electrolyte that will be carried off as a fine film covering the bubbles, just like miniature soap bubbles. The writer has frequently been in battery rooms where this effect could be clearly seen as the bubbles were violently ejected, forming an acid-laden spray that reached several feet over the charging cells; then, as the ventilating currents caught it, it would break up into fine mist, through which it was difficult to see across the room. Of course, whatever this acid spray or mist came in contact with was gradually corroded unless it was something not acted on by sulphuric acid. There are only a few common ma-

terials not affected by this corrosive acid. Among them are lead and glass. For this reason battery terminals, busbars, and all metal connections about the cells of their tanks are well lead-covered or made entirely of lead. The acid spray can be decreased by covering the cells with glass plates upon the lower sides of which the spray will be very largely collected and returned to the cells, provided the plates are not too large, so the acid will flow off onto the floor or outside of the tank or jar. All metalwork throughout the room should preferably be lead-covered or at least heavily coated with red-lead paint or other acid-resisting paint. At the same time good ventilation must be provided, so that the acid-laden air may be drawn out of the room and ejected in a direction where it will do no harm. If an exhaust fan is used, it must be thoroughly painted and frequently repainted. Woodwork likewise must be well painted.

The foregoing remarks on corrosion in battery rooms do not apply to inclosures wherein Edison storage batteries are kept, because the electrolyte of the latter is caustic potash, which is not nearly so corrosive, especially to metals, as sulphuric acid. In fact, such batteries are frequently installed in the same room with delicate apparatus and instruments without harm. Even in this case, however, ventilation should be provided.—J. B., St. Joseph, Mich.

Answer C.—The main requisite of a battery room is good ventilation. And good ventilation may be had by installing air ducts and suction fans, the size and number of which depends on the size of the installation. These fan ducts must be lead-lined, and to prevent the escape of gases to the outer air, where they would condense into an acid film over surrounding objects, their harmful ingredients must be first extracted by passing through a water curtain kept in constant agitation by the fans. A supply of fresh water is piped to the water curtain and the acid is thereby carried with the exhaust water to the drain in the battery-room floor. There is no doubt the maker of the above system will explain further details, if C. D. will correspond with the Massachusetts Fan Company, Watertown, Mass. To protect metal from corrosion a good paint composed mainly of white lead, turpentine and dryer could be used with lampblack to darken the color. Small portions of metalwork or other places where verdigris has developed should be scraped clean and covered with vaseline. There is no danger of explosions in a well-ventilated battery room, but, to be doubly sure, no open light should be carried about during charging, and chances of short circuits in the lighting of the room be kept down to a minimum by keeping the branch lighting circuits outside or above the ceiling, and a flush-type ceiling receptacle used with lamp and socket inclosed by a vapor-proof outer globe.—A. P., Chicago, Ill.

No. 405.—Construction of Four-Way Switches.—I would like some of your readers to furnish a sketch of the actual construction of a four-way switch, such as is used in conjunction with three-way switches for controlling lamps from several points. In the Electrical Review and Western Electrician of March 17, 1917, page 455, there are several clear sketches of such systems, but I do not understand the construction of the switch itself and how it opens and closes the circuit.—V. J. L. N., New York City.

Answer A.—Four-way switches, such as used in the sketches referred to, are of simple construction. Although the details of design vary in different makes, the principle is that of a plain reversing switch. The querist will probably understand it from the two diagrams herewith. As shown, the switch has two contact arcs or segments, each making an arc of a little over 90 degrees. These arcs are entirely insulated from each other, although mounted on the same spindle and controlled together by the same handle, which is shown dotted. In the first position the segments connect the four stationary contacts as follows: 1 and 2, 3 and 4; on reversing the switch, which in this case is done by turning it through 90 degrees, the segments connect the contacts thus: 1 and 3, 2 and 4. It is clear that the circuit on the right side of the switch has in this way been reversed. It must be observed that this switch is only for reversing and does not open and close the circuit. This is probably what confused the querist.—G. A. T., Oshkosh, Wis.

Diagram Showing Principle of Operation of a Four-Way Snap Switch or Reversing Switch.

Answer B.—The different types of four-way switches may vary somewhat as to details of their manufacture, but the object and connections are the same. This switch is used for transposing the lines of any circuit where this is necessary, as when used with the three-way switches in connection with the lighting of any particular lamp or lamps from more than two points. I would suggest that the party desiring this information look very carefully over the several descriptive sketches in the Electrical Review and Western Electrician of date given, as I think he will have no difficulty in obtaining a most clear idea of how the four-way and three-way switches are connected and worked in harmony together. He should note that the two contact strips in the four-way switch are insulated from each other and that snapping the switch results merely in reversing the line controlled.—F. F. H., Milwaukee, Wis.

Scarcity of Electrical Goods in South Africa.

The *South African Mining Journal* in a recent issue says that materials are getting very scarce in Johannesburg, and such things as key sockets at $1.85, as compared with $0.30 in pre-war days, are practically unobtainable. Switches have sharply advanced to $10.50, and very few only are available at that. Wiring is so scarce in some towns on the reef that one is told to supply his own wire to couple up with the mains. Inquiries are active for all electrical material, but business is slow through the acute shortage of materials. Jobbing work and contracts are still taken with a general understanding that approved substitutes can be used. All kinds of electrical cable material are very difficult to obtain, and then it is a matter of negotiation as regards the price. Lamps are being absorbed through wear and tear much faster than supplies arrive for replenishment.

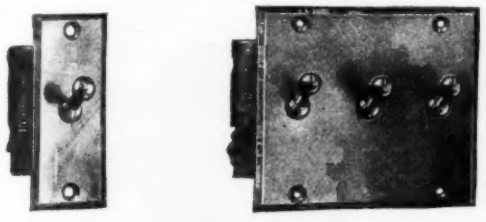
Relief is expected from America, and, may be, from the United Kingdom. Now it would seem that it is more a question of shipping facilities rather than supplies if one is willing to pay the higher values ruling in England. The local demand for motors has fallen off since the municipality cannot supply new electrical power.

Electrical and Power Appliances

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

Hubbell Toggle-Type Switches for Automobile Use.

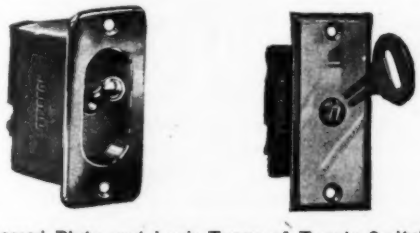
The use of electric lighting on automobiles is now almost as common as electric ignition and anything that makes this lighting still more effective and convenient is therefore bound to be greatly appreciated by all motorists. This is likely to be their attitude toward a new line of automobile switches now being placed on the market by the firm of Harvey Hubbell,



Single and Three-Gang Flush-Plate Toggle Switches for Automobiles.

Inc., Bridgeport, Conn. This new type of switch was designed with the idea of effecting an improvement over existing forms of automobile switches, such as those employing the miniature push button or the single-plunger type, which consists of pulling out and pushing in a small handle. The greater convenience of the toggle switch will appeal to those who have operated either of these types.

In the new toggle switches, which are also known as lever or tumbler switches, it is necessary merely to push the toggle handle up to close the switch; pushing the handle down opens the circuit. This serves as a very convenient indicating feature to any one familiar



Recessed-Plate and Lock Types of Toggle Switches.

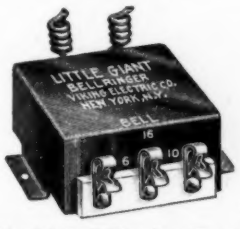
with this standard use of these switches. In appearance the switches are also said to be artistically superior to other forms of automobile switches now on the market.

In construction, the switches are strongly and yet simply made. They have sufficient carrying capacity to handle the load of any automobile battery or magneto circuit; they have successfully withstood tests as high as 50 watts. These toggle switches can now be furnished in single-pole and three-way types with flush plate, single-pole and three-way types with recessed plate, momentary-contact and double form of momentary-contact types for battery magneto circuits, and in single-pole and three-way lock types. Lighting systems of more or less special character can be arranged by gang combinations made up of these various types.

"Little Giant" Bell-Ringing, Toy and Tree-Lighting Transformers.

The Viking Electric Company, 150 Chambers Street, New York City, has recently placed on the market a new line of bell-ringing and toy transformers, to be known as its "Little Giant" line. In designing this line, the company claims to have had two thoughts in mind, namely to produce transformers at the lowest possible price, but at the same time to uphold the Viking reputation for producing very high efficiency and capacity, and to give these transformers individual features of construction which would make it easier for jobbers and dealers to sell and easier for the wireman to install.

Many of the new features to be found in the new Viking line (which includes bell ringers, variable-voltage toy transformers, Christmas-tree-lighting



"Little Giant" Bell-Ringing Transformer.

transformers, automatic cutout transformers, etc., are to be found in the "Little Giant" bell ringer, shown in the accompanying cut and described below.

With the three secondary voltages of 6, 10 and 16, this highly efficient bell ringer enables the electrician to readily determine the proper voltage that will overcome line losses and deliver the required voltage and current at the bell.

The windings and core are imbedded in a special insulating compound and contained within a sheet-iron case. The supporting ears are a part of the main case (not the transformer back); this eliminates any danger to the transformer when being installed.

As shown in the cut, this transformer is provided

"Little Giant" Toy and Tree-Lighting Transformers.

with primary and secondary cleats of Viking invention. These are claimed to be superior to porcelain bushings because there is no possibility of the cleats becoming loosened and causing broken circuits.

The primary cleat is provided on the inside with bosses through which the lead wires pass. The soldered joints are made on the other side of these bosses; this entirely eliminates the possibility of broken joint connections through a strain on the leads.

The secondary cleat is provided with recesses into which are set Fahnestock spring clips for terminals. These clips are riveted solidly through the cleat. This prevents the terminals from becoming loosened, as so frequently happens with the binding-post construction. These clips also enable the electrician to make quick and secure connections, thus they save the wireman's time.

Special Joints to Take Up Linear Expansion of Copper Busbars.

In a great many central-station and industrial power plants the linear expansion of bus runs with changes of temperature has given rise to much difficulty. In some cases this displacement of busbars due to expansion has damaged the insulators used in the bus mounting and in other cases has destroyed the alinement of switches placed in immediate connection with the buses.

The chart shown in Fig. 1 is arranged very conveniently for the direct determination of the actual expansion of a bus run of 100 feet in length over any reasonable range of temperature established in either degrees centigrade or Fahrenheit.

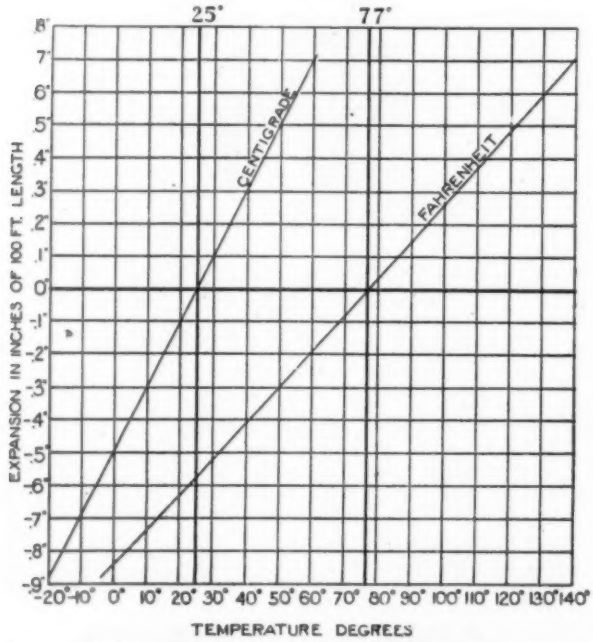


Fig. 1.—Diagram Showing the Linear Expansion of a 100-Foot Copper Bar for Different Temperatures in Centigrade and Fahrenheit Degrees.

For simplicity the expansion is taken both ways from an assumed installation temperature of 25 degrees centigrade (77 degrees Fahrenheit), so that over all ordinary ranges the total expansion for 100 feet of bus run will be the sum of the values shown above and below the installation length. For example, a 100-foot length of bus on which the temperature might vary from 10 degrees centigrade to 55 degrees centigrade, would contract 0.3 inch below installation length at 10 degrees, and expand 0.6 inch over installation length at 55 degrees centigrade, or, disregarding the installation entirely, would have a total change of length of nine-tenths of an inch over the temperature range chosen.

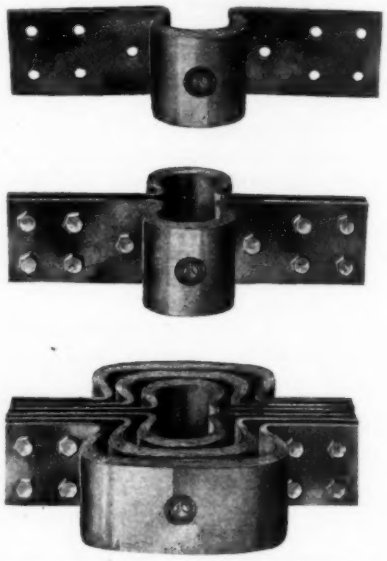


Fig. 2.—Laminated Expansion Joints for Copper Busbars.

The co-operation of the Bureau of Standards in establishing the varying coefficient of expansion for copper has made the presentation of these data in this most convenient chart possible by the engineering department of one of the electrical manufacturers.

Any damage to the insulators or nearby switches may be forestalled by the judicious relief of this bus travel by means of expansion joints. It should be noted that the expansion determined from the chart is the actual expansion and is somewhat greater than the relative expansion of the bar as related to the supporting structure. The latter has generally less expansion over any range of temperature, and is not subjected to such a wide variation of temperature as the busbar itself, nor does it respond so quickly since the temperature variation is first in the room air and not in the building material itself.

To forestall the difficulties arising from busbar expansion, a manufacturer of busbar supports and similar equipment has produced an expansion joint identical in principle to that previously made up and used by several power companies. These joints bolt into the bus and impose no poor connection nor reduction of bar-stack conductivity.

These elements are furnished for stacks of any number of bars of all the bar sizes and spacing common to present practice. The conductivity of the joint is equal to, or greater than, that of the bar stack which it joins, and the joint itself is very flexible because of its thorough lamination.

These joints are produced in all sizes by the General Devices & Fittings Company, Chicago, Ill.

The Soldiers' Home at Columbia Falls, Mont., has installed an electric 80-loaf bake oven which is being served by the Northern Idaho & Montana Power Company. All baking and roasting of meats for the home is now being done electrically.

Voltage Stabilizer for Use on Combination Lighting and Motor Circuits.

In electrical systems of distribution an instantaneous or sustained increase or decrease of current produces a corresponding voltage change, more or less pronounced, depending on the combined regulation of the line and transformer from which power is drawn. If the system is a mixed one supplying a combination load of lamps and motors, then the changes of voltage produce serious results in the form of lamp flicker—even if the voltage variation be only one or two per cent.

An alternating-current voltage stabilizer has been developed by the General Electric Company, which eliminates these objectionable features and makes possible the operation of motors in places where the lighting service must not be impaired.

The stabilizer is essentially a highly reactive transformer having a primary through which the motor current flows and a secondary which is connected in series with the lamp load and boosts by an amount proportional to the voltage drop caused during starting or load change of the motor.

Fig. 1.—New Voltage Stabilizer.

The construction of the stabilizer is simple, as shown by Fig. 1. It consists of a laminated core into which an adjustable air gap has been interposed. On the middle leg of the core structure are interwound the motor and lamp coils. When starting, the rush of current through the motor coil excites the magnetic circuit of the stabilizer and induces a voltage in the lamp coil which is substantially in phase with the lamp voltage. This action is shown in the vector diagram Fig. 2, where E'_1 is the voltage added vectorially by the lamp coil in order to maintain E_1, the lamp voltage, at a constant value. If, however, a transformer, or reactance, is inserted permanently in series with the motor, its terminal voltage is excessively lowered and this might be detrimental since in some cases full load could not be delivered. In the stabilizer this effect is overcome in two ways: First, by designing so that at normal full-load running current the flux density in the iron core is low. This means a correspondingly low voltage drop. Second, by inserting an air gap in the iron core the stabilizer is made highly reactive and most of the drop over the motor coil is in quadrature with the line voltage, except for copper and core losses.

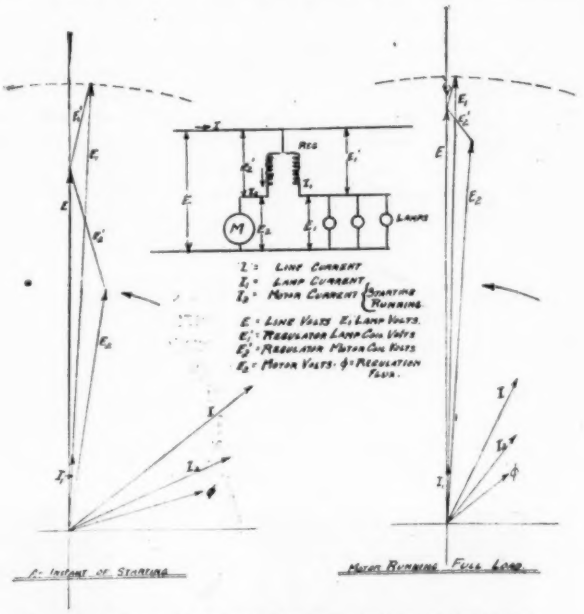

I = Line Current
I1 = Lamp Current
I2 = Motor Current
E = Line Volts E1 Lamp Volts.
E'1 = Regulator Lamp Coil Volts
E'2 = Regulator Motor Coil Volts
E2 = Motor Volts. φ = Regulation Flux.
Lamps
Reg
M
At Instant of Starting
Motor Running Full Load

Fig. 2.—Vector Diagrams Showing Action of Stabilizer.

These losses can and must be kept low in order to make the apparatus efficient. This is shown in the same diagram where E_2 is the motor terminal voltage and E'_2 the voltage drop over the motor coil of the stabilizer.

The stabilizer may be applied to any power apparatus operating in combination with lighting loads. Thus it may be used for general industrial purposes, for hotels and apartment houses and small isolated stations of limited capacity. The nature of the load influences the method of applying the stabilizer, especially where it is required to operate over a wide difference of starting power-factors.

Fig. 3 shows the method of connecting to a single-phase two-wire system. For three-wire, single-phase systems the installation is the same as in the case of the two-wire system, except that an extra coil, properly insulated, is provided as shown in the wiring diagram. The average two-phase system must be treated as two single-phase systems and would usually require two stabilizers unless only one phase were used for lighting, in which case one stabilizer would be sufficient.

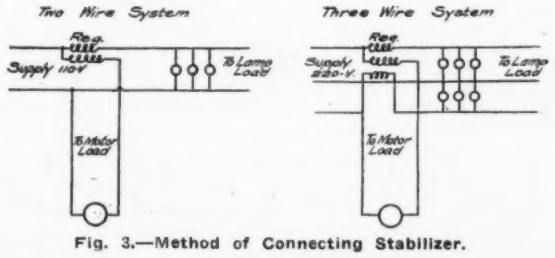


Fig. 3.—Method of Connecting Stabilizer.

Three-phase systems may be regulated considering each phase singly. It is necessary, however, to select the proper motor phase with respect to the lamp lead. Thus, if only one phase is used for lighting one stabil-

izer is required. If all three phases are used for lighting three stabilizers will be required.

The stabilizer operates at a high efficiency, since the core is worked at low flux density and the windings are designed for low copper loss.

Crouse-Hinds Safety Panels and Cabinets.

Control of lighting circuits in large buildings, such as schools, hotels, public buildings and institutions, office buildings and the like, should always be arranged so that the circuits controlling the various lights are readily accessible to a properly authorized person, but are entirely inaccessible to the general public, visitors or inmates in the building. At the same time, since the persons in attendance and who have to control the circuits may be entirely unskilled in electrical matters, it is especially desirable that in operating the switches they be exposed to no hazard from contact with any live parts of the lighting panels.

This idea is excellently carried out in the new line of safety panel cabinets now being placed on the market by the Crouse-Hinds Company, Syracuse, N. Y. These consist of a steel box, within the edge of which is a liberal wiring gutter, separated from the switches and fuses by means of slate partitions or barriers. Within these barriers is the panel proper, which is very neatly arranged with Edison plug-fuse cutouts at the sides and push-button switches mounted on a slate panel in the middle. The outer appearance of one of these cabinets is shown in Fig. 1, where it is evident that the outer door is double, with a smaller panel-like door near its center. Fig. 2 shows this small door open, so as to give access to the switches only. This door need not necessarily be provided with a lock. Fig. 3 shows the large locked door open; this gives access to the fuses as well as the main switch controlling the panel. This construction manifestly promotes safety in that the fuses and live parts of the circuits are not accessible except to the electrician responsible for maintenance. These cabinets are furnished with a steel trim and are designated as form S1. They are also made with a wood outer trim, if it is desired to have this match the finish in the corridor or room where the cabinet is installed.

A modified form of these cabinets is made with the two doors entirely distinct. In this case the outer door is solid without a panel and must be opened to reach the switches. These form a panel inset projecting through the middle of the inner door. The latter must be opened by a separate key to secure access to the switches. It is needless to say that both these types of safety panel cabinets are made for various numbers of branch circuits and also with and without main fuses and switches. Moreover, they are made for two-wire or three-wire distribution, and also with cutouts for standard National Electric Code cartridge fuses instead of plug fuses.

Fig. 1.—Safety Panel Cabinet With Both Doors Closed.

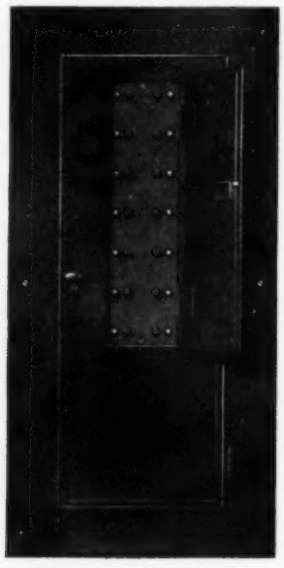


Fig. 2.—Small Door Open to Give Access to Switches.

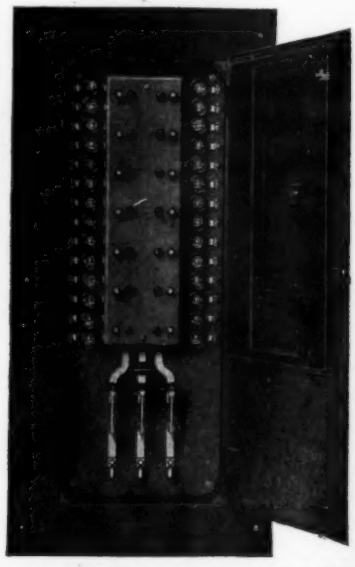


Fig. 3.—Large Door Open to Expose Fuses and Main Switch.

A New Catalytic Spark Plug.

One of the latest improvements in the gas-motor field is the discovery that catalytic combustion will keep the carbon burned off of spark-plug insulators even in the smokiest engine, because it acts on the compression stroke before the air is fouled by the spent gases from the explosion.

The carbon and smoke is burned off the insulator which is kept at a high temperature with heat produced by burning part of the gas-air mixture by catalytic flameless combustion throughout all the time of the compression stroke of the engine when there is always plenty of fresh air in the cylinder.

The new non-carbonizing spark plug is provided, in addition to the electrodes and insulator, with a catalytic structure which produces heat by oxidizing part of the gas-air mixture in contact therewith by local catalytic contact flameless combustion, which is entirely different from ordinary flame combustion, the kind that enflames or explodes the whole gas-air charge and produces power. The non-inflaming catalytic combustion is said to produce plenty of heat to keep the insulator hot, nearly red hot, but it does not interfere with the electric spark ignition which explodes the whole gas-air charge at the proper time to produce the most power. This new non-carbonizing spark plug is the invention of C. K. Harding and is manufactured by the Flameless Combustion Spark Plug Company of Illinois, 6316-20 Stony Island Avenue, Chicago.

Activities in the Trade

Pittsburgh Electric Specialties Company, 149 Broadway, New York City, has leased property at 447 Greenwich Street and 396 Broadway, to provide for increased capacity.

Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., manufacturer of electric controlling devices, rheostats, etc., has increased its capital from $136,000 to $168,000, to accommodate its growing business. Harry L. Bradley is vice-president and general manager.

National Electric Company, Portland, Ore., has been reorganized, with A. S. Hall, a well known electrical engineer, manager. The company is prepared to design and erect electrical power plants and accept contract work. Its offices are in the Railway Exchange Building, Portland.

The A. C. Mannweiler Company, Inc., Fort Wayne, Ind., manufacturer of miniature incandescent automobile lamps and bulbs of the tungsten-filament type has issued new schedules of prices in folder form, for lamps and bulbs of the different voltages and candlepower. The different styles are illustrated.

General Electric Company's Atlanta repair shop is fully equipped to give its customers repair service on all classes of direct and alternating-current apparatus. The same high class of workmanship and materials which has distinguished General Electric apparatus is also employed in all repair work. Correspondence regarding repair work should be addressed to the Engineering Department, General Electric Company, Third National Bank Building, Atlanta, Ga.

Hess & Son, 1031-1033 Chestnut Street, Philadelphia, Pa., manufacturers of Tinol paste solder, have issued a circular describing their Tinol flux paste for soldering purposes. The special claims for this flux paste are its non-corrosiveness, not being injurious, being quick and efficient, ensuring a sound job, which are set forth in detail on page two of the leaflet. A price list on the product in different sized cans and lots, with discount and terms, is given on the last page.

The Locke Insulator Manufacturing Company, with main office at Victor, N. Y., and works at Victor and Lima, N. Y., is sending out its Insulator Book, supplement No. 2, which effectively describes and illustrates latest practical developments in its Victor suspension high-voltage porcelain insulators, clamps and accessories. In presenting the designs the company has drawn freely from the experience of operating engineers and transmission companies, in order to give details of the more substantial and efficient types. Aside from Victor insulators, suspension insulator clamps, strain clamps and suspension insulator attachments, Victor strain yoke sets and Victor arcing horns are illustrated, diagramed and described.

Harvey Hubbell, Inc., Bridgeport, Conn., has prepared a very valuable chart, showing the various types of its reflectors and reflector sockets and the corresponding Mazda lamps that may be used with them. The chart is arranged somewhat like those illustrated in our issue of April 28, 1917. At the left side is shown the particular type of distribution that the reflectors produce. At the top of the chart are shown, in one-seventh of their actual size, the various Mazda lamps, ranging from 10 to 1000 watts. In the respective columns and horizontal lines are shown the different reflectors corresponding to these lamp sizes and types of distribution. This chart has been very strongly commended by at least two of the lamp manufacturers, namely the National Lamp Works of General Electric Company and the Westinghouse Lamp Company. These organizations state to their salesmen and patrons that this chart is found to be not only accurate, but of very great value in selecting an illuminating equipment to fill various requirements. The simplicity of the chart commends it as a handy reference for these illuminating engineering data that are so much needed in rapid determination of industrial lighting problems.

Electrical Engineering Equipment Company, formerly conducting an office at 523 Wells Building, Milwaukee, Wis., is no longer doing business.

The Wellman-Seaver-Morgan Company, Cleveland, Ohio, manufacturer of hydraulic turbines and electric hoists and cranes, is building a large addition to its works at Akron, Ohio. The George A. Fuller Company has the general construction contract.

Ward Leonard Electric Company, Mount Vernon, N. Y., manufacturer of electric controlling devices and vitreous-enamel-insulation resistance units, announces that it is now represented in San Francisco by the Electric Material Company, 589 Howard Street.

Ivanhoe-Regent Works of General Electric Company, Cleveland, Ohio, is distributing its catalog No. 253 on Regent shades, Schedule B, which illustrates 34 different types of shades. The second page of the catalog gives a key to the figures and lettering under the illustrations. Separate price lists are included, giving prices and discounts on these globes under Schedule B, and also on ball globes under Schedule A. Announcement is made of a 10 per cent advance in price on Nos. 963, 983 and 8300 Holophane reflectors, effective November 1.

Defender Automatic Regulator Company, St. Louis, Mo., has issued Bulletin P. This describes briefly and illustrates the "Defender" system of instruments for determining boiler-furnace drafts, flue-gas temperatures and carbon dioxide in as short a time as one minute. The instruments are very compactly arranged, so that they may be mounted either in the boiler room or at any other convenient point. The company has also issued a supplement to Bulletin K, showing special types of vertical draft and pressure gauges, of which four types are illustrated and prices given.

L. Plaut & Company, 432 E. 23d Street, New York, are getting the Four-in-One fixture established in a number of new fields. For instance, the Submarine Boat Corporation, Newark, N. J., has just secured 274 200-watt fixtures to be used in its extensive plant where yet more will be needed. Very exhaustive tests were made before adopting this unit as the standard. The Goodyear Tire & Rubber Company and the Goodrich Rubber Company, both of Akron, Ohio, are between them taking 1600 of the 200 and 300-watt units. The Curtiss Aeroplane Company has also just ordered 343 400-watt units.

Greaves-Etchells Electric Furnace Sales.—The Electric Furnace Construction Company, Philadelphia, has sold Greaves-Etchells electric furnaces to the American Radiator Company, Buffalo, N. Y., which will install a 6-ton furnace in addition to the one of same capacity ordered last September; Stoddard Union Company, Lockport, N. Y., will install a one-ton furnace, and Primos Chemical Company, Primos, Pa., will install one special furnace for making ferroalloys. Eight of these furnaces are now operating or have been contracted for in the United States and T. Waddell & Sons, New Zealand, bought a two-ton furnace.

J. P. Devine Company, with main office and works at Buffalo, N. Y., and branch offices at New York City and London, England, has issued Bulletin 104, describing the Devine patented vacuum drying and impregnating apparatus for armature, field, magnet and transformer coils, etc. The third page of the bulletin prefaces the descriptions of the process by an outline of the company's excellent manufacturing facilities, location and equipment of plant, etc., conducted by master workmen in their specific line. In connection with the outlines of the many uses of this successful drying and impregnating equipment a number of illustrations and diagrams are shown of installations. A page is also devoted to descriptions of its cable dryers and combined cable dryer and vulcanizer. The names and addresses of about 150 users of this apparatus are listed, which is only a partial list and a complete list may be had upon request.

Changes and Activities of Electricial Men

Vail Speaks at Rochester—Chubb goes to People's Light —Franklin with Houghton—Kalenborn in South America

DAVID G. HOWEY, formerly of Barrow, Wis., is now superintendent of the municipal light and water plant at St. Charles, Mich., having succeeded G. E. Tigner in that capacity. Mr. Howey would like to receive catalogs of electrical wiring material and devices, also steam engine and boiler-room devices, etc.

THEODORE N. VAIL, president of the American Telephone & Telegraph Company, was one of the principal speakers at the opening recently of the new Chamber of Commerce Building, Rochester, N. Y. His address was on "Intercommunication Commerce Civilization."

L. C. BEWSEY is now with the mechanical department of the Manila Electric Railroad & Light Corporation, Manila, P. I., which is operated by the J. G. White Management Corporation, New York City. Mr. Bewsey has been connected with various eastern railways, having held responsible positions.

CHESTER N. CHUBB has been appointed general manager of the People's Light Company, a subsidiary of the United Light & Railways Company, which operates in Bettendorf, Davenport and Rockingham, Ia. Prior to this appointment Mr. Chubb was manager of the Northern Indiana Gas & Electric Company, South Bend, Ind.

CORAL A. TYLER, electrical engineer, who formerly was with C. B. Kaner at the big hydroelectric plant at Keokuk, Iowa, is now chief electrician for the Baker-Vawter Company, Benton Harbor, Mich., in whose manufacturing plant he supervised the installation of a large number of new motors, a switchboard, control panels, transformers and lighting distribution.

J. T. CAVANAUGH, superintendent of Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., has been identified with that company since 1906. He is past president of Michigan Electrical Association, since merged into the Michigan Section of the N. E. L. A. Mr. Cavanaugh formerly was superintendent of Public Works at Coldwater, and at Niles, and has been connected with electrical production and distribution and water works since 1886.

ROY B. WOOLEY, formerly sales and advertising manager, Standard Electric Stove Company, Toledo, and late of the American Ambulance Field Service at the Verdun front in France, having served his enlistment, has returned to America. He is now with the Society for Electrical Development, New York, as an executive in its advertising department. Mr. Woolley was with the McManus-Kelley Advertising Agency for some years, and is well known in advertising and electric circles. This completes the reorganization of the Society's staff made necessary by enlistments and war demands.

J. T. STEWART is now with the Standard Electric Construction Company, San Francisco. Mr. Stewart formerly was with the Electric Railway & Manufacturing Supply Company.

A. S. KALENBORN, formerly electrical engineer for the San Joaquin Light & Power Corporation, California, has been appointed electrical engineer and superintendent of power for the Cerro de Pasco Mining Company, Cerro de Pasco, Lima, Peru.

WELLINGTON DUSENBERRY, formerly with the Maryville Electric Light & Power Company, Maryville, Mo., November 1 was appointed manager of the waterworks of Maryville, Mo., by Board of Public Works. It is contemplated to make some necessary improvements at the pumping plant in the near future to take care of the increasing volume of business that is being done.

H. N. GOODELL, who has been Omaha manager for the Western Electric Company since 1912, has been made assistant central district manager and will also look after the Minneapolis branch, although continuing as Omaha manager, with headquarters in the latter city. Mr. Goodell has been with the company for eleven years, having risen step by step in the various departments. Alfred H. Bannister has been made sales manager at Minneapolis.

W. J. DRURY, who was sales manager for the Western Electric Company at Dallas, Tex., has been made manager of the company's Cleveland branch. H. P. Hess, who has been in charge of sales at Houston, succeeds Mr. Drury at Dallas. George L. Chesnut, who has been in the company's service at Dallas since 1908, goes to Houston, to succeed Mr Hess. These men have all been serving the company in various capacities for many years.

E. BURT FENTON, formerly publicity manager of W. S. Barstow & Company, has been appointed publicity agent of the Northern Ohio Traction & Light Company with headquarters at Akron, Ohio. Mr. Fenton graduated into the utilities field from the editorial desk of a daily newspaper, after serving 18 years in that field. His first connection in the utility field was with the Sandusky Gas & Electric Company, for which he did the publicity work through two "municipal ownership" campaigns, the latter of which was followed by a very productive campaign of "good will" advertising. In 1915 he was appointed publicity manager of W. S. Bartow & Company, 50 Pine Street, New York City, in charge of the publicity work of the utility properties controlled by that company. He became temporarily associated with the Northern Ohio Traction & Light Company in August, 1917, and on November 1 was appointed to his present position. Mr. Fenton is the author of "Snuggling Up to John Smith" and "The Missing Link," papers which have attracted wide attention in the utility field. He is a member of the Jovian Order and, until his removal to Ohio, was a member of the entertainment committee of the New York Jovian League.

DR. MILTON W. FRANKLIN, formerly connected with the General Electric Company in the capacity of engineer of the ozonator department, has resigned to become associated with E. F. Houghton & Company, 240 West Somerset Street, Philadelphia, Pa., in the capacity of consulting engineer. Dr. Franklin becomes a member of the board of directors and chairman of the sales committee, and will assume charge of plants, equipment, and manufacturing processes.

C. H. WORDINGHAM was recently elected president of the Institution of Electrical Engineers, which corresponds in Great Britain to our American Institute of Electrical Engineers. Mr Wordingham is one of the leading British electrical engineers. He was a pupil and later assistant to Dr. John Hopkinson. One of his earliest responsible positions was in connection with the central station at Deptford, London, after which he became chief of the municipal electricity station at Manchester, which was highly developed during his connection with it. After several years of consulting engineering practice he was appointed by the British Admiralty to become its first civilian electrical engineer-in-chief. The use of electricity on shipboard was then in its infancy, but he organized an electrical department and brought about the steady increase of electrical apparatus, not only on the British naval vessels but also in the naval dockyards and other land stations. Many important innovations were introduced by him in the design and installation of all the navy electrical equipment put in under his charge. Mr. Wordingham was the second president of the Municipal Electrical Association. For nearly 20 years he has taken a most prominent part also in electrical standardization and since 1902 has been one of the most active members of the Engineering Standards Committee.

Obituary.

EDWARD MOSER, Lehighton, Pa., formerly superintendent of the Leighton electric light plant, died November 8, aged 50 years. He is survived by three brothers and three sisters.

BENJAMIN B. HUNTER, connected with the Camden division of the Public Service Railway Company for 38 years, died November 2, at his home, Sixth and Line Streets, Camden, aged 57 years.

Men in Government Service

Items of Interest Concerning Power and Electrical Men Who Have Joined the Colors

EVERETT MORSS, widely known in the electrical industry, and president of the Simplex Wire & Cable Company, Boston, is now a member of priority committee of the Council of National Defense. Mr. Morss is an alumnus of Massachusetts Institute of Technology. He has been identified with the Simplex company for 32 years.

GENERAL ELECTRIC COMPANY'S roll of honor is now alphabetically listed in booklet form, as a supplement to November issue of General Electric Review. It consists of 20 pages, or 2310 employees' names, giving kind of position held with the company, and branch of military service now in, representing Army, Commissioned Officers, National Guards, Naval Militia, Naval Reserves, Navy Officers' Reserve Corps and Officers' Training Camps. Of the 2310 employees 1021 are listed from the Schenectady works of the company; 494 from the Lynn works; 280 from the Pittsfield works; 117 from the National lamp works; 107 from the Fort Wayne works, 78 from Edison lamp works; 46 from Erie works (which list was incomplete at time of publication); 7 from Sprague Electric works and 160 from district and local offices, including Atlanta, Baltimore, Boston, Charleston, Charlotte, Chicago, Cincinnati, Dallas, Detroit, Milwaukee, New Haven, New York City, Philadelphia, Pittsburgh, Portland, St. Louis, San Francisco, Syracuse and Washington, D. C.

THE MINING & METALLURGICAL SOCIETY OF AMERICA, which includes many men whose work in electric-metallurgy has been of great value to both the Army and Navy, gives the following list of members in service for the United States Government and the Allied Armies: Herbert C. Hoover, food administrator; C. W. Merrill, M. L. Requa and Edgar Rickard, food administration; Lawrence Addicks and W. L. Saunders, member and chairman respectively of U. S. Naval Consulting Board; Percy E. Barbour, captain 22nd Regiment, New York Engineers; Alfred H. Brooks, major of Engineers; Welton J. Crook, Officers' Reserve Corps; Benedict Crowell, major of Ordnance; W. B. Devereaux, jr., captain of Aeronautics; A. S. Dwight, major 11th Engineers; William Hague, first lieutenant, Reserve Engineers; John D. Irving, captain 11th Engineers; Woolsey McA. Johnson, War Trade Board; H. G. Moulton, War Industries Board; Seeley W. Mudd, major of Reserve Engineers; O. B. Perry, engineer Officers' Reserve Corps; Joseph Hyde Pratt, major 105th Engineer Regiment; William Young Westervelt, chairman, War Minerals Committee; Arthur L. Walter, Con. Met. to Chief of Ordnance; Reginald W. Brock, major in Canadian forces; C. H. Macnutt, lieutenant of Engineers in Canadian forces; Gelasio Caetani, first lieutenant, 1st Regiment of Engineers, Italian Army; W. L. Honnold, American Directing Committee for Relief in Belgium; Millard K. Shaler, Honorable Secretary, Committee for Relief in Belgium, and A. L. Queneau, late of the French Army.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW will *welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

Harry G. Smith.

HARRY G. SMITH, who until recently served as assistant secretary of the National Electrical Contractors' Association, having worked zealously for that association since assuming his duties the first of this year, on October 1 entered Government service. At present Mr. Smith is located at Camp Dix, Wrightstown, N. J., and reports enjoying immensely the life of a soldier boy.

MANHATTAN ELECTRICAL SUPPLY COMPANY, Jersey City, N. J., reports the following named employees in military service: Olaf Martinson, in 4th New Jersey Regiment; Edward Lyons, in 7th New York Regiment; Thomas Moran and John Devaney, in naval service; Charles Luther, in Quartermasters' Corps, Syracuse, N. Y.; Edward and Henry Gens are serving in Coast Artillery; William Walsh, in clerical capacity, in Quartermasters' Department.

J. J. CARTHY, chief engineer of the American Telephone & Telegraph Company, lately appointed senior major of Signal Reserve Corps, has been appointed by President Wilson a colonel in the Signal Corps in the regular army, to rank as such from August 15.

BELL TELEPHONE SYSTEM'S service flag, displayed at headquarters, 195 Broadway, New York City, bears the figures 6861 in blue stars. The flag measures 52 by 32 feet and the figures represent employees of the American Telephone & Telegraph Company and its associate companies enrolled or in actual military service. Every state in the union is represented in these figures.

E. C. STOCKDALE, manager of the Chicago office for Page & Hill Company, has been promoted to Major in the Quartermasters' Corps of the United States Army, at present being assigned to the cantonment division at Washington. During construction of cantonments Mr. Stockdale was with the Quartermasters' Corps in a civilian capacity as chief of the material department. The excellent record he made during that period resulted in a commission as a Major being tendered him. At the expiration of his service he will return to Page & Hill organization.

EMPLOYEES OF THE LEEDS & NORTHRUP COMPANY, Philadelphia, who have joined the Army and Navy of the United States, consist of A. Bernick and Hallet Barnes, in Aviation Corps; Charles Loschenski and Louis Wacker, in Naval Coast Reserve; Fred Knorr and Earle Horsey, in National Guard; George English, in National Army. These are out of a total of over 100 who are eligible; but as about 90 per cent of this company's work is for the Government, it is considered that the others are better fitted to serve the nation in these works than in regular military and naval service.

JOHN C. GREENWAY, formerly a mine superintendent in the copper regions of northern Michigan, and later general manager of Calumet & Arizona Copper Company, Bisbee, Ariz., has resigned the latter position to accept the appointment of major of engineers in the United States Army, expecting soon to be in France to supervise the construction work necessary for housing and provisioning American troops in that country. Maj. Greenway served as a lieutenant of the Roosevelt Rough Riders in the Spanish-American war in 1898. He is a man of striking personality, and attracts to himself a following of active, vigorous men, accustomed to doing things.

R. T. PURCHAS, assistant purchasing agent of H. M. Byllesby & Company, has completed the land term in the United States Aviation Corps (Champaign-Urbana field) and has been assigned to the Mineola-Long Island field.

PUBLIC SERVICE COMMISSION for First District, New York City, will soon fly a service flag containing 257 stars. Two members of the Commission, Col. William Hayward and Maj. Henry W. Hodge, and many members of its staff are in one branch or the other of the Government service and some are already in France. Of the above figure 228 are in Army service and the remainder in the Navy. The October number of the Public Service Record, published by the Commission, has been issued as a patriotic service edition and contains the names of men in service, with their respective commands. The list of men in the Army includes: 84 privates, 35 selective draft, 34 second lieutenants, 17 officer candidates, 16 captains, 15 first lieutenants, 9 sergeants, 6 corporals, 3 master gunners, 1 colonel, 1 major, 1 battalion sergeant major, 1 sergeant panter, 1 bugler, 1 machinist, 1 recruit, 1 student, 1 aviation cadet. The list of men in the Navy includes: 5 lieutenants, 4 seamen, 3 ensigns, 3 chief electricians, 3 electricians, 2 yeomen, 1 captain, 1 lieutenant commander, 1 chief machinist's mate, 1 chief yeoman, 1 oiler, 1 musician and 1 boatswain's mate. Men in service comprise 15 per cent of the Commission's staff. A number of committees have been organized among employees to look after the welfare of the men at the front and of those whom they have left at home.

NAUMER ELECTRIC COMPANY, 96 Beekman Street, New York City, November 2 tendered a farewell dinner at Mouquin's to William A. Moritz, of the company, in charge of repair work, who is going to France as top sergeant in the Quartermasters' Division to install and maintain electrical charging apparatus, and to L. F. Tankard, New York office sales manager of the Diehl Manufacturing Company, who will also be a top sergeant in the Mechanical Repair Unit of the Quartermasters' Division in France. They may be called at any time. Mr. Tankard was presented with a radium wrist watch by those attending the dinner, and also a comfort kit by W. B. Tretheway. Mr. Moritz was presented with a radium wrist watch by employees of the Naumer Electric Company, and also a comfort kit by Mr. Tretheway. Mr. Moritz is one of the most expert all-around electricians in New York, having been selected by J. P. Lyons, who is manager of the New York office of the Electric Products Company, Cleveland, Ohio, and who has received a commission as captain and will have Mr. Moritz as general assistant on work which they are to install and maintain at points of debarkation in France. Among those present were: W. B. Tretheway, George Schwab and William Worthe, of the Naumer Electric Company; John Barker, New York sales agent for the Roth motors; Mr. McNutt, of the M. & S. Electric Company; William Koehler and E. W. Fenton, of the Conduit Wiring Company, and P. Baumeister, who has charge of the electrical and mechanical work of the Milbank Memorial Baths and who is also going to France in the Repair Unit as second lieutenant of the Laundry Division.

MAJ. PETER JUNKERSFELD, who in civilian life is assistant to the vice-president of the Commonwealth Edison Company, Chicago, will be the guest of honor at a meeting to be held at the Hotel La Salle, Chicago, on the evening of November 16, under the auspices of the American Society of Mechanical Engineers. Maj. Junkersfeld will tell of his work, which has comprised the supervision of electrical construction at the various army cantonments.

LELAND L. ROUNDS, formerly employed by the National X-Ray Reflector Company at its New York office, has achieved success and distinction as a fighting corporal in the French Flying Corps at the front in France, recently having shot down a German air-plane from the heights above the war zone. It was a year ago that he went oversea and volunteered in an aviation corps of the Allies. After months of training he became efficient in air-craft maneuvering, was promoted to the rank of corporal, and given charge of a machine. His ambition was realized in his first battle. As he flew into the fighting zone in the air, 300 yards inside the German first line of trenches, Corporal Rounds sent one of the enemy planes to the ground. Honors and decorations followed. A blue star on the service flag of National X-Ray Reflector Company, Chicago, represents Corporal Rounds.

Leland L. Rounds.

W. R. OSTRANDER & COMPANY, manufacturers and dealers in electrical supplies, New York City, have furnished their proportion of volunteers for men in Government service, the following being the names of employees who answered the call to the colors: John A. Obermaier and William H. Sholenberg, enlisted in the Navy; Benjamin M. Harris, in Camp Dix Division, National Army; Robert L. Mendelsohn, serving in one of the hospital units. These men were on the firm's office force. Numerous of their factory employees are also in service.

NEW YORK TELEPHONE COMPANY'S employees to the number of 1009 are now in military service and the company is displaying a large service flag at its headquarters building, 15 Dey Street. Although the flag measures 24 by 40 feet, the number of employees to be represented by separate stars is so large that it was necessary to adopt the expedient of using the numerals 1009. These numerals are outlined in blue stars on the white background. Another service flag, bearing the numerals 472 outlined in stars, adorns the entrance to the telephone building at 24 Walker Street, representing men of the company's Bronx, Manhattan and Westchester divisions who are in military service.

LAWRENCE E. CAVANAUGH, son of J. A. Cavanaugh, superintendent of Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., volunteered as first-class electrician in the Navy last April, and has since been advanced to the rank of engineer-ensign, aboard U. S. S. Massachusetts, now on coast patrol duty. He has also been assigned to duties as instructor in marine engineering on that ship. He was formerly employed by Benton Harbor-St. Joe Railway & Light Company. Other employees of this company who are in service in various divisions are Lloyd Shire, Earl Nichols, Otto Moreau, Chester Myers, Lyle Harper, L. P. Briggs and L. W. Sharkey.

WESTERN ELECTRIC COMPANY'S employees enrolled in various branches of military service now number 989, of which 739 are in active service, the remainder being under oath but not yet called. These figures do not include those who have been drafted and who expect to be called at any time. Those who entered service since the last issue of the WESTERN ELECTRIC NEWS are: From CHICAGO—W. J. Blum, P. Des Jardien and H. N. Wood, Reserve Officers' Training Camp; D. J. Rooney, Naval Reserve; J. L. Trenton, Reserve Signal Corps; DALLAS—P. P. Cook, Aviation Section Training Camp; HAWTHORNE manufacturing department—C. A. Cook and R. Goodson, U. S. Army; C. S. Allen and J. C. Tobinski, National Guard; G. Webb, Reserve Officers' Training Camp; G. N. Spurling, British Army; LOS ANGELES—A. Wahlin, U. S. Army; NEW YORK engineering department—H. E. Shreeve, Signal Officers' Reserve Corps, R. H. Hart and A. H. Leigh; SALES AND DISTRIBUTION departments—R. L. Crandall and F. Fastenan, National Guard; S. L. Hoff, Aviation Section Signal Corps; H. G. Meir, U. S. Marine Corps; OMAHA—R. C. Ryan, Ambulance Corps; ST. LOUIS—H. L. Meyers, U. S. Army.

Current Electrical News

WEEKLY RECORD OF CONSTRUCTION ACTIVITIES

EASTERN STATES.

BOSTON, MASS.—Stockholders of the Boston Elevated Railway Company authorized an issue of $2,000,000 15-year bonds.

BOSTON, MASS.—New England Telephone & Telegraph Company, 50 Oliver street, has had preliminary plans prepared for the construction of a telephone exchange plant at Hartford, Vt.

GARDNER, MASS.—Central Oil & Gas Stove Company, 205 School street, has had plans prepared for the erection of a one-story transformer house and one-story pumping station at its plant. Roger E. Coolidge, 34 Chapin street, Southbridge, is architect.

NEWPORT, R. I.—United States Government, Bureau of Yards & Docks, is having plans prepared for the construction of a large power plant at its local naval training station to cost about $900,000. F. R. Harris is chief.

NEW LONDON, CONN.—United States Government, Bureau of Yards & Docks, has awarded a contract for the construction of a power house at the local navy yards, which in connection with another shop structure, will cost about $200,000. Bigelow & Nichols, 45 East Forty-second street, New York, are the contractors. F. R. Harris is chief.

BINGHAMTON, N. Y. — Binghamton Light, Heat & Power Company has inaugurated operations in its new line to the plant of the Endicott-Johnson Company, carrying a load of approximately 500 horsepower. The Endicott company is rushing work on the construction of a leather-board factory, and as soon as this structure is completed, the load will be considerably increased. The company is planning to increase the voltage service of the tie line to 11,000 volts, the original pressure being 2300.

BUFFALO, N. Y.—Empire Engineering Company, Marine Bank Building, has had plans prepared for the construction of a one-story brick and steel power house, about 50x85 feet, on the Sea Wall Strip. The McClintock-Marshall Construction Company, Pottstown, Pa., is the architect.

BUFFALO, N. Y.—Empire Engineering Company has filed plans with the building inspector for a steel power plant to cost $10,000 to be located at the foot of South Michigan street.

CENTRAL ISLIP, L. I., N. Y.—State Hospital Commission has had plans prepared for the erection of a power house at the local hospital. State Architect, Lewis F. Pilcher, Capitol, Albany. E. S. Elwood, secretary.

CHENANGO FORKS, N. Y.—Binghamton Bridge Company, Press Building, Binghamton, is planning for the construction of a brick hydroelectric plant at its local works.

FLUSHING, L. I., N. Y.—New York & Queens Electric Light & Power Company has commenced the construction of a brick substation on Lawrence street, north of Broadway. It is anticipated that the structure will be completed early in 1918.

JOHNSTOWN, N. Y.—Glen Telephone Company has filed notice of an increase in its capitalization from $300,000 to $400,000 to provide for expansion.

ROCHESTER, N. Y.—Rochester Railway & Light Company, 48 Smith street, has had plans prepared for the construction of a four-story addition to its plant, about 32x50 feet. J. P. Haftenkamp is president.

SKANEATELES, N. Y.—Skaneateles Paper Company has commenced the construction of a power house for works operation at its Draycott mills.

TONAWANDA, N. Y. — Fore River Shipbuilding Company, 97 East Howard street, Quincy, Mass., has awarded a contract to the Aberthaw Construction Company, 27 School street, Boston, Mass., for the construction of a one-story local machine shop and power house on Vulcan street.

DOVER, N. J.—New Jersey Power & Light Company is making rapid progress in the construction of an addition to its plant to provide for increased capacity. Immediately upon the completion of the building, new machinery will be installed, to consist of two Babcock & Wilcox boilers which will be equipped with Westinghouse stokers, and one 3500-kilowatt turbine, equipped with Westinghouse condenser.

JERSEY CITY, N. J.—Municipal Light & Power Company has filed notice of an increase in its capitalization from $200,000 to $4,000,000 to provide for expansion.

MORRISTOWN, N. J.—Morris & Somerset Electric Company has commenced the stringing of two miles of new lines to supply service for street lighting to the Township of Chatham. The company is also planning for the immediate installation of new street-lighting system in Green Village, connecting the lines in the Spring Valley section.

TRENTON, N. J.—Due to the fact that the plant of Piper Brothers, 112 Brunswick avenue, has been taken over by the Government to handle war work, the Board of Freeholders has given the concern the right to transfer its contract for alterations and improvements to the power plant at the Overbrook Hospital to Henderson & Company, 835 Springfield avenue, Irvington.

TRENTON, N. J.—American Telephone & Telegraph Company has had plans prepared for the installation of a new underground conduit system in various city streets, to replace the present overhead wires.

ALTOONA, PA.—Penn Central Power & Transmission Company has filed notice with the Public Service Commission of a bond issue of $59,000 to provide for extensions, improvements, etc.

EASTON, PA.—Pennsylvania Utilities Company is making extensive improvements in its Dock street plant, and the capacity has been doubled by the installation of a 5000-kilowatt turbine and two boilers. The company is also planning for the immediate installation of two additional boilers and a new feed water heater. New boiler feed pumps, hot well pumps, circulating pumps, etc., have been installed to handle the increased generating capacity. The company has also made improvements in its South Side plant.

FALMOUTH, PA.—York Haven Power Company is making rapid progress in the construction of a large dam across the Susquehanna River, to reach from the Lancaster County to the York County shore. The dam, which is being constructed at a cost of about $50,000, is to generate more power for the operation of the company's large dynamos.

HANOVER, PA.—General Gas & Electric Company has acquired the W. F. Kintzing Gas Company, Hanover. The company has a site of four and one-half acres, and with improvements under way completed, the plant will comprise five large brick structures, about 93x430; 50x225; 70x80; 120x150; and 50x60 feet.

LANSDALE, PA.—Council has completed the installation of a turbogenerator in the municipal electric plant at a cost of approximately $12,000. An agreement has been authorized, to run for a period of 15 years, providing for the furnishing of electric power to the Borough of Chalfont by the municipal light plant.

MILLERSBURG, PA. — Millersburg Electric Light, Heat & Power Company has made application to the Public Service Commission for permission to consolidate with a number of other electric companies in Dauphin, and Juniata counties, to be known as the Juniata Public Service Company of Clearfield.

MORRISVILLE, PA.—Borough Council is planning for the installation of a new municipal gas and electric light plant.

PHILADELPHIA, PA.—Hulton P. & P. Dyeing Company, Frankford Junction, has awarded a contract to F. Crompton & Brothers, 4614 Oakland street, Philadelphia, for the construction of a one-story brick power house, about 35x110 feet, to cost $8000. The structure will be erected at Coral and Wagner streets.

PHILADELPHIA, PA.—Until Nov. 20, the Board of Public Works will receive bids on a street-lighting contract for a period of one year, effective Jan. 1, 1918, to and inclusive Dec. 31, 1918. George E. Datesman, director.

PHILADELPHIA, PA.—Philadelphia & Reading Railroad has had plans prepared for the construction of a power house at its plant at Emerald and Tulip streets. The structure will be one-story, brick, steel and concrete.

READING, PA.—Metropolitan Edison Company has secured a contract from the Prospect Dye Works for supplying power to its plant for the operation of the works.

ROARING SPRINGS, PA. — Roaring Spring Light, Heat & Power Company has incorporated with a capital of $50,000. A. L. Carver is treasurer.

STROUDSBURG, PA. — Stroudsburg Traction Company has filed notice of a bond issue of $84,000 and stock for $100,000 to provide for improvements, extensions, etc.

ANNAPOLIS, MD.—United States Government, Bureau of Yards and Docks, has had plans prepared for alterations and improvements in its local central power plant and distributing system. F. R. Harris is chief.

BALTIMORE, MD.—Cockran, Hill & Company, 221 South Howard street, are having plans prepared for the construction of a power house addition to its plant, Sixth street and Wilkens avenue. The structure will be three-story, reinforced-concrete, brick, stone and steel.

BALTIMORE, MD. — Baltimore Dry Docks & Shipbuilding Company has awarded a contract for the construction of a one-story reinforced-concrete and brick power house, about 57x69 feet, at its plant. The West Construction Company, Baltimore, is the contractor.

BALTIMORE, MD. — Crown Cork & Seal Company, Guilford avenue, has awarded a contract for the erection of an addition to its power house at Highlandtown, Md. The West Construction Company, Baltimore, has the contract.

BALTIMORE, MD.—Plans for the new power-distribution station for the Consolidated Gas & Electric Light & Power Company for the erection on Customhouse avenue are being prepared by the company's engineers. Contract will be awarded in the spring.

RICHMOND, VA.—Richmond Terminal Company, First National Bank Building, has awarded a contract for the construction of a new three-story signal tower, about 20x30 feet. John T. Wilson Company, Mutual Building, Richmond, is the contractor.

LEWISBURG, W. VA.—A local company has been organized to take over the old Lewisburg & Ronceverte Electric Railway property and complete the line into Lewisburg.

CHARLESTON, S. C.—United States Government, Bureau of Yards & Docks, has had plans prepared for extensive improvements in its power plant at the local navy yards to cost about $100,000. F. R. Harris, chief.

WALHALLA, S. C.—Herrick Hosiery Mills is planning for the complete electrification of its plant.

GENEVA, FLA.—Osceola Cypress Company, recently organized to engage in the lumber business, is planning for the construction of a new electric plant at its proposed works at St. John's River and the Florida East Coast Railroad. E. L. Hunter is president.

PENSACOLA, FLA.—Pensacola Electric Company will expend $75,000 in improvements, which include moving its tracks from the bayshore line further away from Palmetto Beach, as storms each year wash up tracks, etc., causing heavy damage. A new motor car equipped with four 75-horsepower motors has been ordered by the company, as well as four more large passenger coaches, to give good service between city and navy yard. The company has announced a reduction in fares, as well as issuance of transfers to and from city lines.

NORTH CENTRAL STATES.

BOLIVAR, O.—H. L. Doherty & Company, 60 Wall street, New York City, to which the Alliance Gas & Power Company, of Alliance, and the Massillon Electric & Gas Company, of Massillon, are subsidiary, has started work on erecting a large power plant here. The first expenditure on the plant will be $2,225,000 and the plant is expected to be in operation by July 1, 1918. It will be able to furnish power to Alliance, Massillon, Orrville and a number of other towns in the vicinity. The work is in charge of Engineer H. I. Baker.

CALEDONIA, O.—Electric lighting bonds for $10,000 will be offered for sale Nov. 26.

CHILLICOTHE, O.—Government will extend the Chillicothe Street Railway to Camp Sherman, making a double track system and using a loop system at the Camp.

LIMA, O.—Lima Telephone & Telegraph Company increased its capital stock by $800,000, making the capital now $1,000,000. State Public Utilities Commission recently authorized the company to sell $60,000 in stock to pay for permanent additions to the plant. The remaining amount, $140,000, will remain in the treasury to meet expenses of future improvements.

MANSFIELD, O.—Mansfield & Electric Light & Power Company, a subsidiary of Cities Service Company, has contracted to purchase the property and franchises of the Mansfield Railway, Light & Power Company. The acquisition of Mansfield's traction lines has been under consideration for some time, and the application to combine the two Mansfield properties has been filed with the Ohio Public Utilities Commission.

MIDVALE, O.—Northern Ohio Traction & Light Company has plans ready for a power house 25x25 feet. The offices of the company are in the Hamilton Building, Akron, O. The architect is F. C. Warner, 767 Hippodrome Annex, Cleveland, O.

TOLEDO, O.—Ways and means are under consideration to make changes in the electric lighting of streets and alleys.

GARY, IND.—Gary Street Railway Company has petitioned public utilities of Indianapolis for permission to issue $375,000 for the improvement of the Gary lines of the company.

RICHMOND, IND.—At meeting of the council ornamental lighting for North E street was suggested by the Public Improvement Committee; also ornamental lights on North Eighth street, near the Union Station.

CHICAGO, ILL.—Chicago Shipbuilding Company, a subsidiary of the American Shipbuilding Company, has completed plans for an electric power plant at its South Chicago shipyards, located at 101st street and the Calumet River. The estimated cost is $15,000. The Roberts-Burchard-Wales Company, 623 Swetland Building, Cleveland, O., is the architect.

WAUKEGAN, ILL.—Public Service Company of Northern Illinois will make improvements to treble the capacity of local plant. Main office, 72 West Adams street, Chicago, Ill.

DETROIT, MICH.—John H. Busby Company, electrical contractor, has increased its capital stock from $10,000 to $50,000.

EATON RAPIDS, MICH.—At the regular election to be held in this city December 3, the question of bonding the city for $30,000 for buying the water powers at Eaton Rapids and Smithville, two miles up Grand River from here, will be submitted.

DATES AHEAD.

American Institute of Consulting Engineers, Inc. Annual meeting, January 14. Secretary, F. A. Molitor, 35 Nassau Street, New York City.

Electrical Contractors' Association of State of Missouri. Annual convention, January 19. Secretary, A. J. Burns, 318 West Tenth Street, Kansas City, Mo.

Minnesota Electrical Contractors' Association. Annual convention, Minneapolis, Minn., January 20. Secretary, G. M. Jones, 112 South Seventh Street, Minneapolis.

Illinois Electrical Contractors' Association. Semi-annual convention, Chicago, January, 1918. Secretary, L. B. Van Nuys, Central Electric Company of Peoria, Peoria, Ill.

Western Association of Electrical Inspectors. Annual meeting, Memphis, Tenn., January 29-30-31. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

LANSING, MICH.—Detroit Electric Welder Company has increased its capital from $100,000 to $150,000.

ANTIGO, WIS.—The new flour mill of Hirt Bros. will be the largest user of electric power in this city, with the installation of motors aggregating 155 horsepower. There will be two 50-horsepower motors, two 15-horsepower, two 10- and one 5-horsepower. The mill is being wired for electric lights, of which there will be well over 100. The lighting installation will be very complete and permit of night as well as day operation. Machinery is being placed and the mill will begin operation within three weeks.

EAU CLAIRE, WIS.—Gillette Rubber Company, manufacturer of tires, has completed one of the most modern and up-to-date power houses and heating plants in Wisconsin. The building is fireproof, 65x81 feet and about five stories high. A stack in the center of the building is 14 feet 10 inches in diameter at the base, 8 feet at the top and 175 feet high. Two 315-horsepower Sterling boilers will be installed now and the building is being made large enough to install another set of boilers when needed. Hydraulic pumps will also be installed and an open switchboard connecting pipes and wires between the power house and factory will be run through an underground tunnel. Overhead coal bunkers will be constructed large enough to hold 650 tons each. Coal and ashes will be handled by automatic stokers. The company expects to have the power house completed and in operation by February 1. A boiler and transformer house will be added. R. B. Gillette is vice president and general manager of the company.

GREEN BAY, WIS.—Members of a special committee of the Green Bay Association of Commerce will study the problem of ornamental lighting in streets in the business districts in the east and west sides. They will get in touch with companies manufacturing modern lamps and posts, and obtain prices and all possible information in that connection.

GRESHAM, WIS.—Citizens have voted to issue $14,000 in bonds for buying the water power and electric lighting plant from Richards Bros.

MANITOWOC, WIS.—Wisconsin Public Service Company, of Green Bay, has been granted franchise to operate in Manitowoc, after fighting two years for same. It now has the privilege to operate in the city, to use alleys and streets and to string cables and place poles. An alderman protested against giving the company a franchise because he believed it permitted competition with the city plant, and the company eventually might control the power situation in the city.

MARATHON, WIS.—Franchise has been granted to the Wisconsin Valley Electric Company, Wausau, for the erection of an electric lighting plant.

MILWAUKEE, WIS.—Plans have been completed for the installation of electric lamps on Auditorium Square; also for the installation of electric lamps for the entire length of Wisconsin street.

STANLEY, WIS.—The new electric lighting plant here is nearing completion.

MONTEVIDEO, MINN.—Northern States Power Company contemplates the construction of a two-story building to be 25x40 feet.

BURLINGTON, IA.—A movement is being made to extend the ornamental lighting system from Jefferson street up Third to Columbia, about six blocks.

CONWAY, IA.—Council has passed ordinance granting 25-year franchise for an electric lighting system to furnish lights for the business houses, residences and principal streets of Conway. A. A. McKay has asked to be granted the franchise, which will be put up to vote at a special election to be held Dec. 3.

GRANT CITY, MO.—W. C. Childers sold his electric light plant to a man from Maryville, who is representing a St. Louis syndicate. A 10-year franchise, voted last April, goes with the sale; also a contract with the city council running for a period of five years for lighting the public square is included in the deal. The power will be furnished from Maryville as soon as the line can be extended from Maryville to Grant City.

KANSAS CITY, MO.—Kansas City Light & Power Company put into operation on Nov. 12 at its central station a new 3400-kilowatt steam turbine. This will aid greatly in relieving the shortage of power which caused the curtailing to a number of the city's industrial plants during the past month.

OZARK, MO.—At a meeting of the citizens of Ozark recently called by the mayor and president of the Business Men's League for the purpose of discussing ways and means of preventing the sale of the electric light plant, which is to take place soon, it was decided to endeavor to make up a local company to take it over. The meeting was presided over by John W. Robertson, president of the league. It was agreed that the mortgagees would take half the stock on a $15,000 basis and citizens of Ozark be asked to subscribe the balance of the stock to the amount of $7500.

PLEASANT HILL, MO.—L. K. Green & Sons' new central energy electric plant here is now in operation, supplying service for Belton, Grandview, Lees Summit, Pleasant Hill and Raymore. It is said to be one of the largest electric plants in the country and capable of handling a great many towns.

ST. JOSEPH, MO.—City council will not accept the latest proposal of the street railway company for lighting the streets of St. Joseph.

ST. LOUIS, MO.—The electric wiring in the City Hall in East St. Louis and also in the fire-engine house has been improperly installed and must be changed to comply with State fire regulations was learned last week. Changes that must be made in the City Hall will require the expenditure of $500. The Arcade building, one of the largest office buildings in the city, has been ordered to change its entire lighting system.

ALTAMONT, KANS.—City is to vote on electric light plant soon. It has a chance to get the current from the same company that furnishes Pittsburg, Parsons and Independence.

ATCHISON, KANS.—Blair Milling Company has leased a tract of land south of the Union Station for a power house. It will be equipped with generators and all the machinery of the Blair wheat and corn products mills will be electrically driven. Power will also be generated for the Blair elevator located at the corner of Tenth and Main streets. The power house will develop 1200 horsepower and will have a large smoke stack. Work on the new plant will begin at once.

EL DORADO, KANS.—Mr. Wells, city manager, proposes a system of lights be installed on North Main street north of Sixth avenue where the present white way ends.

INDEPENDENCE, KANS.—Bids will be opened Nov. 15 for the white way throughout the business districts. Notice for bids will include dual purpose poles that the trolley wires may be fastened to.

IRVING, KANS.—Ordinance passed relating to a contract for purchase of electric current with the Marshall County Power & Light Company, of Blue Rapids, Kans., and authorizing the mayor and city clerk to sign same on behalf of City of Irving.

JENNINGS, KANS.—The electric light plant has been sold to T. A. Vonada.

JUNCTION CITY, KANS.—Rockyford Power Company has been sold to A. D. Jellison and Harry Pierce, of this city, and G. A. Rogers and C. L. Brown, of Abilene. The consideration was over $300,000. The lines of the Riverside Pow-

er & Light Company, Abilene, will be connected with the Rockyford company.

KANSAS CITY, KANS.—Ordinance was passed relating to and providing for the issue of bonds for the purpose of extending the electric light plant and works to supply the city and its inhabitants with electric light; bonds to be issued in the sum of $25,000.

LEAVENWORTH, KANS.—Leavenworth Light, Heat & Power Company Nov. 5 made application to the state charter board for permission to increase its capital stock from $1,000,000 to $1,150,000.

McCRACKEN, KANS.—The election to vote $12,000 additional bonds for the extension of the electric light system carried.

HARTINGTON, NEB.—Contract has been let to the Nebraska Electric Company for the installation of an electric lighting system.

REYNOLDS, NEB.—The question of an electric lighting plant for Reynolds is now agitating the minds of the people.

SHELTON, NEB.—Contract has been let to the Central Power Company, Grand Island, for the installation of an electric lighting system on Main street.

DELL RAPIDS, S. D.—Northern States Power Company is contemplating the building of transmission lines from Dell Rapids about eight miles out.

HIGHMORE, S. D.—A bond issue of $10,000 for the erection of an electric lighting plant carried at election.

GARRISON, N. D.—Installation of an electric lighting plant is being considered.

WILLOW CITY, N. D.—Minot Electric Company has been granted franchise for the construction of an electric lighting system.

SOUTH CENTRAL STATES.

LOUISVILLE, KY.—American Tobacco Company, 900 South Eighth street, has awarded a contract to Sanford Vaughn, Paul Jones building, Louisville, for the remodeling of its one-story power house.

BIRMINGHAM, ALA.—Alabama Interurban Development Corporation has incorporated with a capital of $70,000. The object is to connect Bessemer and all suburbs by an interurban line with the Warrior River, enabling the shippers to take advantage of the waterway for the slower consignments. Thomas L. Cannon is president of the corporation.

BUFFALO, ARK.—Standard Zinc Company is contemplating the erection of a hydroelectric plant on Buffalo River.

CAMDEN, ARK.—Arkansas Light & Power Company's boiler room was destroyed by fire recently, leaving the city without light or water.

BRISTOW, OKLA.—City council and the commercial club are preparing to make a campaign, the purpose being to take over the electric lighting plant in this city. When franchise was granted the electric light company a clause was included which gives the city the right to take over the plant at any time.

BRISTOW, OKLA.—Southwestern Telephone Company is considering leasing the entire second floor in the Abraham Building. Its present quarters have been outgrown and the company will soon install a new 20-position board which will call for more room. The new plant will be of the central energy type.

HAILEYVILLE, OKLA.—Election to vote on proposition of granting franchise to the Choctaw Power & Light Company, its successors and assigns, the right to construct, maintain and operate an electric plant and distribution system, carried.

LOCO, OKLA.—G. A. Fletcher & Company will install an electric lighting plant. Contracts have been made to light the Taylor Sanitarium and the Tubknux Hotel. A contract may be made also for street lights.

LOCUST GROVE, OKLA.—An order granting the Locust Grove Light & Power Company permission to dismantle its plant here was issued by the state corporation commission recently. The company set forth in the petition that it was no longer able to operate its plant, and that the poles were decaying and wires falling in the streets.

MIAMI, OKLA.—Mayor John L. Crank has received and in turn given assurance that proceeds from the recent $200,000 bond issue for civic improvements in Miami soon will be available. Specifications have been submitted for a part of the work, and it is expected that the entire amount will be expended for electric lights, waterworks, storm sewer and sanitary sewer extensions and fire department betterments within the coming year.

QUAPAW, OKLA.—Southwestern Bell Telephone Company, which has expended near $75,000 in Ottawa county principally in the mining district in the last year, is now making arrangements to establish an exchange at Quapaw. Work has started on the new exchange and will be completed in about 30 days.

TULSA, OKLA.—Board of city commissioners Oct. 26 instructed John Meserve, city attorney, to prepare at once an ordinance which will force all companies operating telegraph, telephone or electrical wires within the fire zone of this city, to place such lines under ground.

VINITA, OKLA.—Versailles Telephone Company proposes to erect a one-story brick veneer building 28x40 for its telephone exchange on property recently acquired.

BEAUMONT, TEX.—Beaumont Iron Works will soon install additional machinery and other equipment including electric transformers in its plant here.

BREMOND, TEX.—Bremond Electric Light Company was destroyed by fire recently.

DALLAS, TEX.—Plans are now being formulated for the improvements and extensions designated in the Strickland-Hobson franchises. A meeting for this purpose was held recently, at which time M. N. Baker, supervisor of public utilities, Mayor Lawther and representatives of both the Dallas Power & Light Company and the Dallas Railway Company were present.

DALLAS, TEX.—Dallas Southwestern Traction Company has placed a large force of men at work constructing its interurban electric railway that is to run from Dallas to Cleburne. The division between Dallas and Irving will be completed and placed in operation within the next six months, it is stated. The Creek Construction Company of Sapulpa, Okla., has the contract.

HEREFORD, TEX.—City council plans to submit to the vote of the taxpayers the proposition of either purchasing the local electric light and power plant from the Hereford Light & Power Company, or to build a municipal plant here.

HEREFORD, TEX.—D. L. McDonald has bought ground a few feet from the Santa Fe passenger station, and is planning to install an electrically-operated pumping plant that will discharge 2000 gallons of water a minute.

HOUSTON, TEX.—Sinclair Gulf Company has expended $11,000,000 for the construction of a refinery and the laying of a system of pipe lines. The Sinclair Gulf Refining Company has been organized as a subsidiary of the Sinclair company for the purpose of building and operating the new plant. The plant will cost about $6,000,000. The pipe line will cost about $5,000,000. Address H. F. Sinclair, president, Houston.

WESTERN STATES.

BUTTE, MONT.—Plans are being made for several miles of ornamental street lighting.

MISSOULA, MONT.—A lighting system will be installed on campus at the State University consisting of nine 400-candlepower lamps.

WHITEFISH, MONT.—Northern Idaho & Montana Power Company is contemplating the installation of a street lighting system.

BISBEE, ARIZ.—City council will order an election soon to vote on issuing $375,000 bonds, the proceeds to be used in constructing a new electric lighting plant, water works system and gas manufacturing plant.

KINGMAN, ARIZ.—For several years surveys have been in progress for a dam across the Colorado River near the mouth of Diamond Creek, 22 miles north of Peach Springs. It is said that plans have been perfected for a 200 feet wide concrete dam. The project primarily is for the purpose of developing electric power in enormous quantity to be wired to the mines of the southwest and possibly to be used in the operation of the main line of the Santa Fe Railroad across Arizona.

SNOWFLAKE, ARIZ.—Citizens of Snowflake, Taylor and Shumway have organized the Silver Creek Electric Light Company. It will be capitalized for $50,000 and $15,000 will be paid in by Jan. 1. Work on the power plant will start at once. Address J. J. Shumway.

TUCSON, ARIZ.—City engineer estimates that a new lighting system, embracing all the newly paved streets in the city, could be installed for about $17,000.

BRIGHAM CITY, UTAH.—Reclamation Power Company, through Engineer H. S. Kleinschmidt, of Salt Lake City, has filed on 28 cubic feet of water in Box Elder Creek to be used from Jan. 1 to Dec. 31 inclusive, each year for power purposes. The company proposes to erect a power plant and furnish light and power in this city. The water at the head of Box Elder Canyon in section 20 is to be diverted and conveyed a distance of 5300 feet by means of a pipe line and there used for generating electric power.

LA CONNER, WASH.—City and vicinity raised $21,000 for construction of a power line from Mount Vernon to be constructed by the Puget Sound Traction Light & Power Company.

OROVILLE, WASH.—Ordinance has been passed granting Okanogan Valley Power Company right to erect and maintain an electric transmission system over the streets of the city.

SEATTLE, WASH.—American Nitrogen Products Company, Securities Building, Seattle, which has a large plant at La Grande, Wash., is making surveys for a railroad to bring materials to the site of the proposed $3,000,000 dam it is to construct on the north fork of the Sauk-Suiattle River. The railroad is to run from Darrington and is to be 18 miles long.

SEATTLE, WASH.—City council has passed an ordinance for $40,000 in utility bonds for the extension of Division "A" of the municipal street railway to Market street and Leary avenue. An ordinance was also introduced transferring $35,000 from the general fund to the municipal railway construction fund 1917, in addition to $20,000 already transferred from the general fund. This means that it is not the intention of the council at present to rely on the sale of bonds to extend the road.

SEATTLE, WASH.—Skinner & Eddy Corporation has completed plans for the construction of a foundry building 150x60 feet, adjoining the third machine shop now under construction. Plans also have been perfected for another 125-foot ship outfitting slip to be 100 feet wide. These improvements will total $200,000, which, with the two outfitting slips and the new machine shop will make over $1,000,000 worth of building improvements started by the company in three months.

CANYON CITY, ORE.—An electric street-lighting system is to be installed here.

ANTIOCH, CAL.—Mason Bros., of Sausalito, with the co-operation of John Buck and the Matson people, have secured a tract of 90 acres of land here and will erect a plant to cost $500,000 for manufacturing potash, acetone, sulphate of ammonia, etc. Work on the buildings is to start at once.

CHICO, CAL.—Board of trustees will soon call for bids on a five-year contract for lighting the streets of the city.

LOS ANGELES, CAL.—Board of Supervisors has approved a contract for installing improvements and furnishing electric current in the Verdugo lighting district.

LOS ANGELES, CAL.—Hammond Electric Protection Company has been incorporated here with a capital stock of $250,000, by W. D. Hammond, C. E. Rees, W. L. Gilbert, F. C. Mason and B. N. Hammond.

LOS ANGELES, CAL.—Southern California Edison Company has been authorized by California Railroad Commission to use $3,885,018 to pay part of certain notes and accounts due, this being the amount spent for additions to its plant, properties and equipment. Some months ago the commission authorized the company to issue, at not less than $88 a share, 32,000 shares of its common capital stock, the proceeds to acquire in whole or part $5,000,000 bonds issued by the Pacific Light & Power Corporation, which concern was acquired by the Edison company; or to discharge obligations not to exceed $2,480,405.

MARICOPA, CAL.—Midway Oil Company is having all the residences and bunkhouses on its property in the Sunset field, formerly lighted with gas, wired for electricity, also its derricks on producing as well as on drilling wells.

MERCED, CAL.—San Joaquin Light & Power Corporation has bought the Merced Stone Company's plant and power lines at Kittridge and will extend them to several mining claims, as well as Coulterville. The Merced Stone Company has been generating electricity at its plant for energy at mines and has secured power from the San Joaquin corporation. A. G. Wilson, general manager of the San Joaquin Light & Power Corporation, stated the plant was bought for the purpose of development in Mariposa County and especially to be in position to furnish power for use at the mines.

OAKLAND, CAL.—Contracts are being let for the building to be erected on Franklin street, near Fifteenth, for the Pacific Telephone & Telegraph Company at a cost of $150,000.

OAKLAND, CAL.—General Electric Company has bought a site at Peralta and Sixteenth street. The company will double the capacity of the plant.

OAKLAND, CAL.—Occidental Chemical Company, recently incorporated, will erect a potash factory to cost $350,000. The incorporators are: F. A. Williamson, George H. Morse, C. C. Waits, Henry G. Tardy and M. H. Collor.

SACRAMENTO, CAL.—Eastern Nevada Power Company has been granted authority by the California Corporation Commissioner to sell 1000 shares of its 7 per cent cumulative preferred stock at par, $100 per share. This is the first issue of a proposed sale of 15,000 shares, the proceeds to be used for the development of the Ruby Mountain power project in Nevada. It is estimated that the cost of constructing the first unit, which will develop about 4800 horsepower delivered at Ely, 150 miles from the power house, will cost $1,100,000. The company has issued 25,000 shares of common stock to Frank B. Ench in exchange for water rights.

SAN FRANCISCO, CAL.—Gas & Electric Sales Company has been incorporated here with a capital stock of $40,000, by Thomas Steel, M. J. Purcell, V. A. Kuehn, L. M. Olds and A. C. Duerr.

SAN FRANCISCO, CAL.—Haller-Cunningham Electric Company has leased the entire floor of the building at 437 Market street.

SAN FRANCISCO, CAL.—State Railroad Commission has authorized the San Joaquin Light & Power Corporation to operate under a franchise granted it by Maricopa County in that portion of the county not now served by any other utility of like character.

SAN FRANCISCO, CAL.—H. S. Tuttle has been awarded the contract for installing electric conductors and appurtenances for the Market street line of the municipal railways.

SANTA BARBARA, CAL.—City engineer has been requested by council to prepare an estimate of cost of utilizing the water from the proposed Gibraltar and Mission Canyon dams for development of power. An estimate prepared by the water department places the cost of a power plant at Mission Canyon dam at $146,368 and a power plant at Gibraltar dam at $66,000.

STOCKTON, CAL.—Samson Sieve-Grip Tractor Company, which is served by the Western States Gas & Electric Company, has added 150 horsepower to its electric load.

TAHOE CITY, CAL.—L. J. Moore, of this city, has applied to the State Water Commission for the appropriation of water from Slim Jim creek, tributary to Lake Tahoe, for the development of electrical power. The cost of his project is estimated at $10,000.

INCORPORATIONS

ALBANY, N. Y.—Vecchio Manufacturing Company. Capital, $10,000; to manufacture electrical machinery of various kinds. Incorporators: J. A. Pabula, L. Vecchio and F. Mondello, Albany.

NEW YORK, N. Y.—H. B. Shontz Company. Capital, $50,000; to manufacture electric batteries, engines, etc. Incorporators: J. A. Smith, H. B. Shontz and P. J. Durham, 244 West Forty-ninth street, New York.

EAST LIVERPOOL, O.—Steubenville, East Liverpool & Beaver Valley Traction Company. Capital, $4,500,000.

PHILADELPHIA, PA.—Rural Service Company. Capital, $500,000. To install lighting and heating systems. Incorporators: F. S. Brown, Philadelphia; Robert Penington, Wilmington, Del., and Joseph P. Bryan, Dover, Del.

PROPOSALS

ELECTRIC GENERATING EQUIPMENT.—Sealed bids will be received in the office of the Custodian, United States Sanatorium, Ft. Stanton, N. M., for furnishing and delivering f. o. b. cars, Capitan, N. M., one 50-kilowatt, 2-wire, 110-volt, direct current, direct connected electric generating equipment, engine to be single cylinder, noncondensing piston valve type, and generator must be capable of operating in parallel with a 40-kilowatt Skinner engine. Bids are desired preferably for a new engine and generator, but a second-hand outfit in first-class operating condition will be considered. James A. Wetmore, acting supervising architect, Washington, D. C.

POWER PLANT IMPROVEMENTS.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a. m., November 26, and then publicly opened, for piping and accessories, coal bunkers, structural-steel foundations, induced draft fans and miscellaneous work in connection with the installation of new equipment in the power plant at the navy yard, Charleston, S. C. Drawings and specification No. 2661 may be obtained on application to above mentioned bureau or to the commandant of the navy yard or naval station named.

ELECTRIC-DUCT SYSTEM.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a. m., November 26, for an electric-duct system at the United States naval projectile plant, Charleston, W. Va. Drawings and specification No. 2669 may be obtained on application to the bureau.

ALTERNATORS AND LINE MATERIAL.—Bids will be received at Charleston, Miss., until Nov. 20 for improvements to be made in the municipal electric lighting plant, to include alternators and line materials. J. M. O'Neal, commissioner of water and lights.

TRENCHING WATER MAINS.—Frank Barber, township engineer, 40 Jarvis street, Toronto, Canada, will receive bids until Nov. 26 for treinching and laying water mains in Lauder and Glenholme avenues.

MOTOR-DRIVEN COMBINED FLUSHER AND SPRINKLER.—M. J. Desmond, city clerk, City Hall building, Sacramento, Cal., will receive bids until Nov. 20 for furnishing and delivering one motor-driven combined flusher and sprinkler with a 1200-gallon capacity tank.

ELECTRIC LIGHTING SYSTEM.—Robert Adamson, fire commissioner, 11th floor, Municipal building, Manhattan, N. Y., will receive bids until 10:30 a. m., Nov. 20, for furnishing material and installing electric lighting system at quarters of Engine Company Nos. 237 and 246, Borough of Brooklyn.

ENGINE HOUSE AND MACHINE SHOP.—Samuel T. Wagner, chief engineer, 522 Reading Terminal, Philadelphia, will receive bids until noon, Nov. 25, for constructing engine house and machine shop, Erie avenue yards, Third and Erie avenue, Philadelphia.

Electrical Patents Issued October 30, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,244,454. Fan-Hanger Outlet. F. B. Adam, assignor to F. A. Electric Co., St. Louis, Mo. For mounting on side wall.

1,244,459. Control System. H. L. Beach, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Electro pneumatic motor control.

1,244,473. Insulating Support. C. W. Covell, assignor to Westinghouse Electric & Mfg. Co. A top plate is mounted on a metal pin by means of petticoat insulators.

1,244,475. Switchboard Lamp. H. D. Currier, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. For telephone switchboard signaling.

1,244,476. Current-Collecting Device. J. S. Dean, assignor to Westinghouse Electric & Mfg. Co. Structure of brush holder.

1,244,477. Telegraphy. P. B. Delany, assignor to Secret Telegraph Co., New York, N. Y. System for protecting secrecy of messages.

1,244,478. Controller. I. Deutsch, assignor to Westinghouse Electric & Mfg. Co. Motor controller of drum type with resistance mounted on drum.

1,244,480. Fan Construction. L. M. Dieterich, assignor to Safety Car Heating & Lighting Co. Structure of motor-driven ceiling fan.

1,244,483. Vapor-Rectifier. S. W. Farnsworth, assignor to Westinghouse Electric & Mfg. Co. Liquid electrode has submerged metal plate with grooves in its upper surface, secured to container.

1,244,486. Vacuum-Type Converter System. C. Le G. Fortesque, assignor to Westinghouse Electric & Mfg. Co. A maintaining reactance device is included in a circuit resonant to the frequency of riffles in the rectified current.

No. 1,244,652—Reinforced Concrete Pole.

1,244,488. Telephone-Exchange System. C. L. Goodrum, assignor to Western Electric Co., New York, N. Y. Semi-automatic.

1,244,492. Control System. A. J. Hall, assignor to Westinghouse Electric & Mfg. Co. Electropneumatic railway-motor-control system.

1,244,504. Continuous Zinc Smelter. W. McA. Johnson, Hartford, Conn. Unitary Smelting apparatus comprising an internally heated electric furnace.

1,244,509. Dynamo-Electric Machine. B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Has special structure of ventilating vent.

1,244,510 and 1,244,511. Universal Motor. B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Arrangements of windings, etc., of motors for operating on either direct or alternating current.

1,244,518. Method of and Apparatus for Producing Sparkless Commutation. J. C. Lincoln, assignor to Lincoln Electric Co., Cleveland, O. For use in a divided-pole, drum-wound, rotary converter.

1,244,528. Vacuum Lightning-Arrester. D. T. May, assignor to Western Electric Co. Has a short-circuiting device controlled by deliquescent material.

1,244,544. Selector. C. S. Rhoads, Jr., assignor to Western Electric Co. Electro-

magnetically operated, step-by-step code signaling device.

1,244,545. Switching Device. L. G. Riley, assignor to Westinghouse Electric & Mfg. Co. Relates to the interrelation of main and reversing drums of a controller.

1,244,546. Device for Setting the Selective Controlling Apparatus on a Moving Automatic Goods Conveyor or Trucker from a Fixed Station. L. Rottenburg, London, England. Structure of contact apparatus.

1,244,555. Shielding System for Vapor-Converters. E. F. Sipher, assignor to Westinghouse Electric & Mfg. Co. Structure and arrangement of cylindrical shield about electrodes.

1,244,558. Battery Elevator. T. G. Stiles, Arlington, N. J. Details of structure and electrical connections.

1,244,569. Means for Interconverting Alternating and Direct Currents. J. L. Woodbridge, Philadelphia, Pa. Commutator apparatus and windings.

1,244,571. Telephone-Exchange System. J. L. Wright, assignor to J. R. Garfield, Cleveland, O. Semi-automatic.

1,244,587. Successive Non-Interference Signal Box. F. W. Cole, assignor to Gamewell Fire Alarm Telegraph Co., New York, N. Y. Details of train and controlling means of a fire-alarm box.

1,244,589. Inclosed Electric Fuse. R. C. Cole, assignor to Johns-Pratt Co., Hartford, Conn. Details of structure of renewable type.

1,244,614. Process of and Apparatus for Interconverting and Adjusting the Relative voltage of High-Potential Alternating and Direct Electric Currents. C. G. Koppitz, Youngstown, O. Special connections of windings through which the alternating current passes to a commutator.

1,244,615. Fitting for Electroliers. K. Kornbau, New Dorp, N. Y. Details of candle-like mounting for lamp.

1,244,634. Electrical Attachment for Reading Meters. A. C. Neff, Urbana, O., and E. H. Ford, Wabash, Ind. For use with an integrator meter for measuring values of different denominations.

1,244,642. Electrical Apparatus. A. Pruessman, assignor to Western Electric Co. Manner of encasing and insulating apparatus operating under service conditions of high temperature.

1,244,652. Sectional Cement Telegraph Pole. G. T. Southgate, Brooklyn, N. Y. Details of reinforced-concrete structure.

1,244,660. Lock-Switch. B. P. Swyers, assignor to Motors Lock Co. of America, Pittsburgh, Pa. Structural details.

1,244,667. Auxiliary Constant Fuel Supply Apparatus for Automobiles. J. W. Wellington, Jackson, Mich. Has special float-controlled switch for controlling motor of pump supplying fuel tank.

1,244,671. Lock. P. L. Wikheim, Everett, Wash. Structure of switchlock having contacts controlled by plug which may be slid and rotated by an inserted key.

1,244,693. Measuring Apparatus. R. S. Blair, New Rochelle, N. Y. Electrical indicating means and means for eliminating the slip of a rotary ship's log.

1,244,697. Wireless Receiving System. J. R. Carson, assignor to American Telephone & Telegraph Co. For use in a system wherein the signals are transmitted by a modulated high-frequency carrier wave.

1,244,705. Method of Electric-Arc Welding, Heating and Metal-Working, and Apparatus Therefor. C. L. Coffin, assignor to Electric Metal Working Co., Detroit, Mich. Manner of rotating the electrodes to produce distribution of the heat and steadier action of the arc flame.

1,244,709. Winding for Dynamo-Electric Machines. J. C. Davenport, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Details of formed armature coil.

1,244,720. Electric Switch. A. H. Englund, assignor to Electric Service Supplies Co., Philadelphia, Pa. Hand-operated switch for insertion in a trolley.

1,244,816. Measured-Service Telephone System. B. D. Willis, assignor to Automatic Electric Co., Chicago, Ill. For use with automatic systems.

1,244,817. Electric Heater for Hot-Water Tanks. R. A. Willson, Spokane, Wash. Structure of heater for application to exterior cylindrical surface of tank.

1,244,819. Light-Projector and Tongue Depressor. E. I. Young, assignor to Throt-A-Lite Co., Atlanta, Ga. Device with battery light for making examination of the throat.

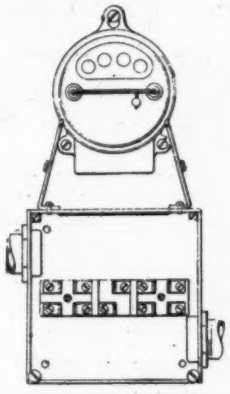
1,244,844. Spark Plug for Internal-Combustion Engines and the Like. E. I. Dodds, assignor to Flannery Bolt Co., Pittsburgh, Pa. Structural details.

1,244,868. Dynamo-Electric Machine. G. M. Larsson, assignor to Eck Dynamo & Motor Co. Special interpole field structure.

1,244,873. Signaling Apparatus. F. W. Lohr, New York, N. Y. Device having several indicating faces is motor operated and has faces selected by an electromagnet.

1,244,880. Focusing Device for Lamps. W. M. Matteoli, Covington, Ky. For automobile headlights.

1,244,909. Filing Device for Battery Cells. J. M. Skinner, assignor to Philadelphia Storage Battery Co., Philadelphia, Pa. Cell cover structure.



No. 1,245,036—Meter Protector.

1,244,926. Electrical Distributer. C. J. Wallace, Springfield, O. Controller for automobile starting and ignition circuits.

1,244,927. Distributer for Automobile Circuits. C. J. Wallace. Modification of above.

1,244,929. Rheostat. H. W. Ward, Detroit, Mich. Comprises alternate disks of metal and carbon with means for varying the connections thereto.

1,244,936. Electric Train-Line Coupling. H. F. Woernley, assignor to Westinghouse Air Brake Co., Wilmerding, Pa. Structure of device comprising a cam-operated contact carrier.

1,244,949. Electric Coupling. T. R. Brown, assignor to Westinghouse Air Brake Co. Has a fluid-pressure-operated contact carrier.

1,244,950. Electric Train-Line Coupling. T. R. Brown, assignor to Westinghouse Air Brake Co. Has electrically operated contact carrier.

1,244,959. Electrically Illuminated Advertising Device. H. Conover, Chicago, Ill. Casing having a stage with back, intermediate and fore grounds is illuminated by electric lamps controllable as to color.

1,244,960. Electric Distribution. J. L. Creveling, assignor to Safety Car Heating & Lighting Co. Axle-driven car-lighting system.

1,244,983. Alternating-Current Dynamo-Electric Machine. L. J. Hunt, assignor to General Electric Co. Motor has special windings to give cascade working for starting.

1,244,998. Selective Signaling System. A. E. Lundell, assignor to Western Electric Co. For telephone party lines.

1,244,999. Telephone-Exchange System. A. E. Londell, assignor to Western Electric Co. Manual system.

1,245,006. Light-Ray Deflector. C. E. Mentzer, Des Moines, Iowa. For automobile headlights.

1,245,014. Electrical Protective Apparatus. F. R. Parker, Chicago, Ill. Electrothermal apparatus for telephone lines.

1,245,029. Hanger for Light Transmitting Bowls. J. T. Robb, Bay Shore, and W. E. Jerome, Rockville Center, N. Y. Structural details.

1,245,034. Winding and Reeling Device for Electric Conductors. P. J. Ruffalo, Mount Vernon, N. Y. Structural details of reel and mountain with provision for making electrical connections with the conductors.

1,245,036. Protective Casing for Electric Service Connections and Meter Devices. J. Sachs, Hartford, Conn. Details of knock-down structure (See cut).

1,245,037. Multiple-Meter Adapter. J. Sachs. Adapter for co-operative association with a number of meters.

1,245,038. Meter-Testing Appurtenance. J. Sachs. Arrangement for establishing co-operative connection of a meter and testing appliance.

1,245,039. Electric Motor. A. C. Sargent, assignor to Sargent Electrical Brake Co., Des Moines, Iowa. Details of switch for mounting in conjunction with the steering wheel of vehicle.

1,245,047. Conduit-Hanger. H. B. Sherman, Battle Creek, Mich. Clamp structure for securing a hanger ring to the base of an I-beam.

1,245,048. Signal. J. Shiflet, McKeesport, Pa. An upright rod carrying a signal is rotated by electromagnet.

1,245,068. Attachment-Plug Fitting. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Receptacle has lamp which is lighted when plug is inserted.

1,245,077. Junction-Box Coupling for Electric Wire Conduits. L. E. Webster, assignor to Weber Mfg. Co., Wilkes-Barre, Pa. Details of construction.

1,245,080. Battery-Separator. F. E. Whitney, assignor to Commercial Truck Co. of America, Philadelphia, Pa. A thin sheet of insulation has a series of slots approximately 0.0125 of an inch wide.

1,245,083. Illuminating Device. R. B. Benjamin, assignor to Benjamin Electric Mfg Co., Chicago, Ill. Structure of headlight.

1,245,084. Electric Heater. E. N. Brown, assignor to Majestic Electric Development Co., San Francisco, Cal. Reflector heater with protective cage.

1,245,103. Electric Switch. J. S. Hickman, Titusville, Fla. Details of special structure.

1,245,105. Flasher. F. Hotchner, assignor to S. Hotchner, San Francisco, Cal. Contact structure.

1,245,135. Detector. J. Thompson and R. J. Thompson, Elk Grove, Cal. For wireless; of the coherer type.

Patents Expired.

The following United States electrical patents expired on November 13, 1917:

661,491. Emergency Brake Switch. W. M. Brown, Johnstown, Pa.

661,498. Electric Fuse. J. L. Cohen, New York, N. Y.

661,516. Trolley. H. S. Goughnour, Johnstown, Pa.

661,518. Controlling Device for Electric Circuits. E. W. Hammer, Chicago, Ill.

661,520. Automatic Steering Device for Torpedoes. C. D. Haskins, Newton, Mass.

661,538. Brush Holder for Dynamo-electric Machines. C. W. Kragh, Madison, Wis.

661,578. Toll-collecting Device for Telephones. W. A. Foss, Cleveland, O.

661,588 and 661,589. Electric Welding Apparatus. A. F. Rietzel, Lynn, Mass.

661,600. Trolley Wheel. T. I. Duffy and C. McMahan, Chicago, Ill.

661,619. Method of Recording and Reproducing Sounds or Signals. V. Poulsen, Copenhagen, Denmark.

661,666. System of Electric Train Control. C. B. Martin, New York, N. Y.

661,669. Connecting Conductors to Carbon Brushes. A. L. Rohrer, Schenectady, N. Y.

661,714. Telephone Circuit. I. H. Farnham, Wellesley, and G. W. Davis, Revere, Mass.

661,731 and 661,732. Thermostatic Device. R. G. Callum, Washington, D. C.

661,740. Chime of Bells. H. Kruschwitz, Neu-Untermhaus, Germany.

661,742. Circuit Controller for Electric Engines. H. Letord, Orlando, Fla., and J. S. Letord, Kansas City, Mo.

661,771. Electric Circuit-breaker. B. P. Rucker, Philadelphia, Pa.

661,820. Electrical Apparatus. M. Schupner, Nyack, N. Y.

661,839. Dash-pot for Electric Arc Lamps. T. E. Adams, Cleveland, O.

661,880. Electric Brake Controller. J. C. Lincoln, Cleveland, O.

Re-issue. 11,872. Traveling Contact for Electric Railways. Thomson-Houston Electric Company, Boston, Mass.

Financial News and Comment

HIGHER YIELDS ON UTILITY PREFERRED SHARES.

In spite of the abnormally low values to which practically all stocks have fallen, including those of public utilities, it is interesting to note that the Financial World states: "Many of the public utility preferred stocks which have a sustained record of dividends for years have been working toward a basis of prices to yield nearly, if not quite, 10 per cent. The change has been brought about not so much by any really adverse factor in the matter of intrinsic worth but by the general market conditions which have brought about so many abnormalities in the public utility, industrial and transportation fields. Wherever one delves he finds bargains in public utilities and only temporarily depressed conditions to account for the low prices."

Reports of Earnings.

UNITED GAS & ELECTRIC CORPORATION.

	1917	1916
September gross	$1,345,420	$1,271,069
Tax after renewals and replacement res.	482,611	492,113
Surplus after charges.	201,335	258,660
Twelve months' gross.	16,010,244	14,772,468
Net after tax and renew and replacement res.	5,651,097	5,677,463
Surplus after charges and preferred dividends	1,382,447	1,481,168

United Gas & Electric Corporation received as its proportion of the surplus earnings of subsidiary companies for the 12 months ended September 30, 1917, $1,186,219. Total income amounted to $1,451,053. After charges of $653,008, there was a balance of $798,045 left for the dividends on the first preferred stock. Balance after the dividends, which amounted to $649,936, was $148,109.

VIRGINIA RAILWAY & POWER COMPANY.

Report for fiscal year ended June 30, 1917.

	1917.	1916.
Gross earnings	$6,044,495	$5,645,158
Operating expenses.	2,941,293	2,676,179
Net earnings	$3,103,202	$2,968,979
Other income	98,391	96,610
Gross income	$3,201,593	$3,065,589
Taxes, etc.	387,672	327,631
Fixed charges	1,429,385	1,415,037
Other charges	192,449	68,804
Depreciation	359,904	100,000
Balance	$832,183	$1,754,117
Preferred dividends.	476,352	472,752
Common dividends.	358,482	358,482
Deficit	$2,651	$322,883

NORTHERN POWER COMPANY.

	1917.	1916.
September gross	$ 8,382,072	$ 8,072,261
Net after taxes	2,626,451	3,485,519
Net operating income*	2,616,132	3,417,820
Nine months' gross.	64,759,846	59,580,534
Net after taxes	17,196,213	19,477,987
Net operating income*	17,588,084	19,509,620

*Net operating income, a new item in these reports is the balance after debiting or crediting hire of equipment, rental of joint facilities, and other similar operating items.

BYLLESBY UTILITY EARNINGS.

Combined earnings for the year ended September 30, 1917, compared with the corresponding previous year are:

	1917.	1916.
Gross earnings	$18,499,332	$16,649,362
Net earnings	8,623,105	8,190,423

TENNESSEE RAILWAY, LIGHT & POWER COMPANY.

(Inter-company items eliminated)

	1917	1916
September gross	$ 410,940	443,095
Net after taxes	68,628	176,400
Deficit after charges	67,884	*54,973
Twelve months' gross	5,217,676	4,722,101
Net after taxes	1,883,076	2,176,497
Surplus after charges	351,070	697,882

*Surplus.

Out of every $100 of investment in the United States, in the following classes of securities, the average annual amount in the hands of receivers, over a period of years is:

National Banks	$ .32
Public Utilities	.37
Railroads	1.84
Industrials	2.07

HUDSON & MANHATTAN.

	1917	1916
September gross	$ 508,219	$ 475,988
Net after taxes	766,875	257,142
Surplus after charges	48,856	42,752
Three months' gross	1,484,579	1,370,638
Net after taxes	758,058	741,400
Surplus after charges	104,941	97,661

TACOMA RAILWAY & POWER COMPANY.

The annual report of the Tacoma Railway & Power Company has been filed with the Public Service Commission of Washington, covering the operations for the calendar year, 1916. During the year, 23,615,660 passengers were hauled, of which 5,753,037 were free transfer passengers. In addition, 802,405 employees and other persons were carried free, a total of 24,418,065. The operating expenses were $689,103.40, which included $436,207.77 wages and salaries. The average fare collected was 3.69 cents per passenger. There were but two fatal accidents on the lines during the year, with 99 passenger cars and 65 freight cars in operation, and the total track mileage is 102.2.

MISSISSIPPI POWER COMPANY.

	1917	Increase
September gross	$ 172,903	21,564
Net	143,504	24,507
Surplus after charges.	22,940	10,824
Twelve months' gross.	1,920,781	217,077
Net	1,552,419	185,820
Surplus after charges.	226,656	137,796

KEOKUK ELECTRIC COMPANY.

	1917	Increase
September gross	$ 22,986	$ 2,568
Net	7,634	1,306
Surplus after charges	5,280	985
Twelve months' gross	245,555	5,999
Net	75,475	*7,795
Surplus after charges	49,478	*10,729

*Decrease.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid Nov. 6.	Bid Nov. 13.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	..	13	13
Adirondack Electric Power of Glens Falls, preferred	6	62	62
American Gas & Electric of New York, common	10+extra	95	95
American Gas & Electric of New York, preferred	6	40	40
American Light & Traction of New York, common	..	203	200
American Light & Traction of New York, preferred	6	96	93
American Power & Light of New York, common	4	30	30
American Power & Light of New York, preferred	6	74	68
American Public Utilities of Grand Rapids, common	..	26	24
American Public Utilities of Grand Rapids, preferred	6	57	58
American Telephone & Telegraph of New York	..	110½	107
American Water Works & Elec. of New York, common	..	4	4
American Water Works & Elec. of New York, particip	7	10	10
American Water Works & Elec. of New York, first preferred	..	59	59
Appalachian Power of Bluefield, common	..	1	1
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	200	185
Cities Service of New York, preferred	6	76 1/6	75
Commonwealth Edison of Chicago	8	105½	101½
Comm. Power, Railway & Light of Jackson, common	4	38	36
Comm. Power, Railway & Light of Jackson, preferred	6	68	64
Federal Light & Traction of New York, common	..	5	5
Federal Light & Traction of New York, preferred	..	25	30
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	2+2 extra	32	28
Middle West Utilities of Chicago, preferred	6	60	55
Northern States Power of Chicago, common	ex div.7	58	58
Northern States Power of Chicago, preferred	ex div.7	88	87
Pacific Gas & Electric of San Francisco, common	5	37½	36½
Pacific Gas & Electric of San Francisco, preferred	6	81	80
Public Service of Northern Illinois, Chicago, common	7	74	75
Public Service of Northern Illinois, Chicago, preferred	6	90	88
Republic Railway & Light of Youngstown, common	4	20	19
Republic Railway & Light of Youngstown, preferred	6	57	55
Standard Gas & Electric of Chicago, common	..	5	5
Standard Gas & Electric of Chicago, preferred	6	27	24
Tennessee Railway, Light & Power of Chattanooga, common	..	2	4½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10	10
United Light & Railways of Grand Rapids, common	4	30	25
United Light & Railways of Grand Rapids, preferred	6	59	57
Western Power of San Francisco, common	..	8	7
Western Power of San Francisco, preferred	6	45	44
Western Union Telegraph of New York	extra	83	..
Industrials—			
Electric Storage of Philadelphia, common	4	48½	47½
General Electric of Schenectady	8	128	123
National Carbon of Cleveland, common	8	55	56
National Carbon of Cleveland, preferred	..	120	120
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	37	38¼
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	55	56

*Last sale.